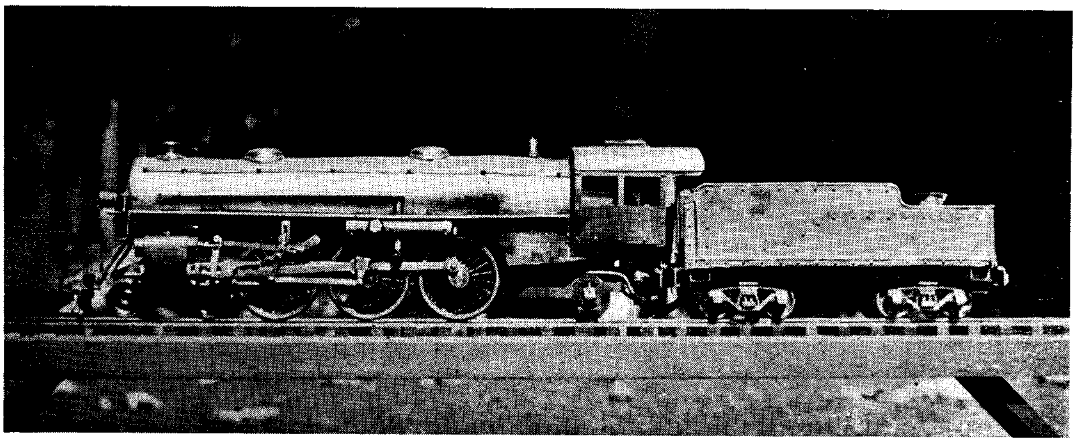
Easy Hull Construction

THE MODEL ENGINEER

Vol. 82 No. 2038 • THURS., MAY 30, 1940 • SIXPENCE

In this issue

This photograph shows an example of an American reader's activities in miniature locomotive construction. The engine was built by Mr. Baine Isaacson, of Buellton, California, castings for wheels and other details being obtained from one of the American trade firms; it is for $2\frac{1}{2}$-inch gauge, and has proved itself an efficient passenger-hauler.



THE MODEL ENGINEER

Vol. 82 No. 2038

60 Kingsway, London, W.C.2

May 30th, 1940

Smoke Rings

Instrument Making

I MUST thank those readers who have responded to my notification of vacancies for training as instrument makers, offered by a South Lancashire firm. These replies have been duly forwarded to that firm for consideration.

* * *

Model Electric Railway Controls

THE operation of model electric railways by central control is developing beyond the main objectives of train dispatching, signalling, and switching. Devices have been introduced in America for electric coupling and uncoupling, and for the unloading of freight cars. In one case a coal wagon is made to tilt at a pre-determined spot and unload its consignment of coal alongside the track. Another device causes a box car to open and discharge a packing case, while on a flat log-carrying car, the side-stakes lower and the logs roll off. There seems to be no limit to model railway operation which the pressing of a button, or the turning of a switch, will not accomplish.

* * *

Some Australian Models

A RECENT note from Mr. Albyn A. Stewart, of Sydney, N.S.W. enclosed some photographs of models he has recently added to his extensive collection. These included several ship models shown afloat on Mr. Stewart's test pond. One of historic interest is the London Missionary Society's steamer *John William*, a 3-masted vessel, the prototype having accomplished 30 years of service between Sydney and the South Sea Islands. A 6-ft. model of the *Laurentic* makes a fine appearance. Her power plant is interesting from the fact that the three propellers are driven by three separate engines. The starboard engine, with a cylinder $\frac{3}{4}$ in. × $\frac{3}{4}$ in., is compounded across to the port engine, with a cylinder $1\frac{1}{4}$ in. × $\frac{3}{4}$ in., and the central propeller is driven by a pair of single-acting horizontal enclosed engines of $\frac{3}{4}$ in. bore. The boiler is of the semi-water-tube type, and gives plenty of steam at full speed. Another good-looking model is of the Hunter River Company's old steamer *City of Brisbane*, a paddler which was scrapped 40 years ago. She is 6 ft. 6 in. in length, and is driven by a compound diagonal engine with cylinders $\frac{3}{4}$ in. and $1\frac{1}{4}$ in. by $1\frac{1}{2}$ in. stroke. The paddle wheels are 8 in. diameter. Mr. Stewart's interest in marine practice is shown by a photo of a set of engines and boiler for a model steam yacht, complete with air, circulating, and feed pumps.

* * *

The Scrap Box

IN this hour of National emergency, there is naturally a great campaign for the collection of scrap materials of all kinds and the salvage of waste. While is it essential that all scrap metals of any appreciable bulk of weight should be devoted to building of ships and armaments, there are many "bits and pieces" of no real value to the nation by reason of their diminutive character, which may wisely be added to the model engineer's scrap box in the home workshop. Tin boxes and containers often thrown away may be turned to useful account, and on the junk heap or on the market stall there are to be found oddments of bicycles, wringers, coffee grinders, old wireless sets, and similar appliances in perhaps a decrepit and incomplete condition, from which much useful material may be rescued at a trifling cost. The shortage of new metal and materials is being felt in many directions in the model engineering world, and it now behoves the model maker who wishes to keep his workshop going to exercise his ingenuity in using such scrap material as may come his way. So many admirable models "made from scrap" have been shown in past years at the "M.E." exhibitions, that the present shortage of material should not be regarded as a period for despair, or cessation of activity, but as an incentive to the further display of resource and imagination.

* * *

Heavy Loading on the L.N.E.R.

LOCOMOTIVE enthusiasts will be very interested to know of two recent feats of haulage that have occurred on the L.N.E.R. Engine No. 4800, of the "Green Arrow" 2-6-2 Mixed Traffic type, hauled a passenger train of 26 vehicles, weighing 762 tons, tare, from Peterborough to London. With passengers and luggage, the load exceeded a total of 800 tons, and easily eclipsed all previous records. The streamlined 4-6-2 engine, No. 2509, *Silver Link*, was responsible for the second effort, when on the 1.0 p.m. from King's Cross, she hauled 25 vehicles weighing 750 tons tare to Darlington, and continued to Newcastle with a train of 734 tons tare. Her own weight is 103 tons, without tender, while the weight of No. 4800 is 93 tons.

* * *

Cotebrook Garden Fete

THIS function, which was so successful last year, will be repeated on Saturday, 15th June, next, in the grounds of Cotebrook House, Tarporley, Cheshire. A Challenge Cup will be offered in two classes: (I) The best flying model aeroplane; and (II) the best exhibit among other models. No entrance fee will be charged in either competition. All intending competitors can obtain complimentary tickets from The Rev. T. Bayard Webster, The Curatage, Cotebrook, Tarporley, who will also welcome the loan of any locomotives or rolling-stock to run on his "OO" gauge railway which will again be working. Other arrangements will be similar to those of last year, so far as prevailing conditions permit; and there will be an extra award for the best model made by a junior at school.

Percival Marshall

*Gauges and Gauging

By R. Barnard Way

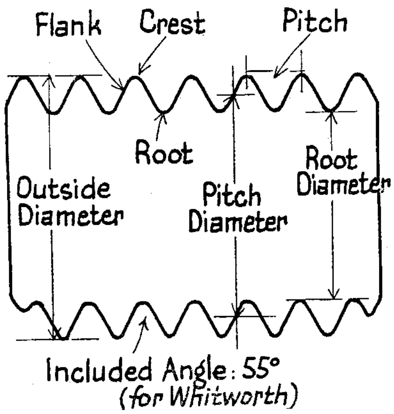
Concluding a valuable series of articles

THE basis of all accurate measuring being dependent upon some application of the working of a screw into or out of a nut, we are finally confronted with the job of producing an accurate screw thread. It is natural perhaps, to think that the gauging tool or machine that we expect to give us accurate measurements, precise to such limits as 0.00001 in, must be provided with a dividing screw made to limits even more accurate still. Well, we shall see.

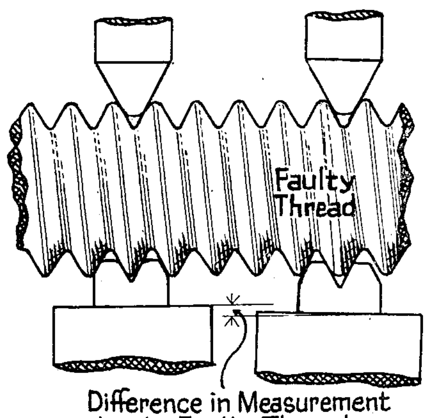
It might be as well to quote the time-honoured example of the engineering firm who were asked to make a lead-screw 20 ft. long, 3½ in. in diameter, having four Acme threads to the inch. The tolerance on the pitch diameter and the lead (per inch) was specified as ± 0.0001 in. The estimate for the job was £2,000, for amongst other things every test of the screw was going to cost £4, and naturally this led to enquiries as to whether such accuracy was really essential. It seems that it was not, for only one nut was required, and that was to be made by the same firm. In the end the job was done for £63, and the working of the screw was fully up to the standard originally specified. Why should this be so?

Here is a profile of the Whitworth Standard Thread, showing the five essential features that must be considered if our thread is to be absolutely true. And that will be very difficult indeed to get, as the figures will show.

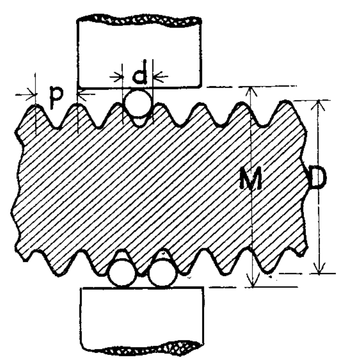
First we have the outside diameter; this needs no explanation. Then the core, or root diameter, measured between the roots of the threads. The third diameter, and in a sense, the most important of all, is the pitch diameter, established by ruling a straight line at right angles to the centre line of the screw. The length of this line between the points at which it cuts the threads on either side is the pitch diameter. It is also referred to as the effective diameter.



All these features of the screw thread have to be considered when it is being gauged.



Thread gauging by micrometer caliper.



The three-wire method of thread gauging.

The pitch—most important of all—is the distance between successive crests of threads, and the lead is the distance travelled by the screw when making one complete turn into the nut.

For detailed examination we can take any thread at random, so consider the ¼ in. bolt and nut, with 20 threads to the inch. The outside diameter of the bolt may be 0.2500 in. but not less than 0.2482 in., and the corresponding dimension of the nut 0.2528 in. and 0.2505 in.—thus we get a tolerance of 0.0018 in. Will it be necessary to work to the ten-thousandth part of an inch when cutting a thread on a quarter-inch bolt? We think not, but it may be desirable to go somewhere near that when making threads for micrometer screws.

The specification of the Whitworth Standards states that the depth of any thread is to be 0.640327 times to pitch, and the radius of rounding of crest and root is to be 0.137329 times the pitch. If the draughtsman in his enthusiasm for accuracy insists (by marking on his drawing) on such dimensions, then there is going to be trouble.

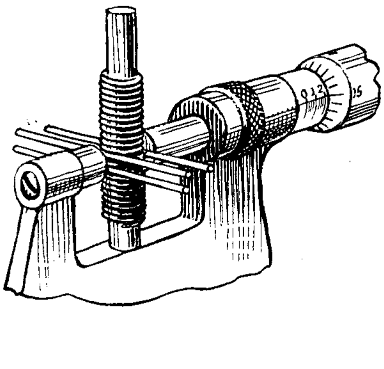
Fortunately there is not the slightest need for any such standard whatever. Much of the trouble arises from the conversion of fractions into decimals, so that a perfectly simple dimension like 1 5/32 in., that obviously calls for no extreme precision, becomes 1.15625 in. when converted to decimals. Do we immediately go into a panic when a drawing appears dimensioned in decimals instead of fractions? We might get excited if they were all carried to such an extent as four or five places.

Most micrometer screws are made to be accurate in pitch first of all, the full diameter is not important, in fact it is quite certain that the crests of the threads in screw and nut will be considerably relieved in order to provide for lubrication as well as accumulated dirt. So they concentrate upon the flanks of the thread, securing an accurate angle. This is not so difficult with the screw as with the nut.

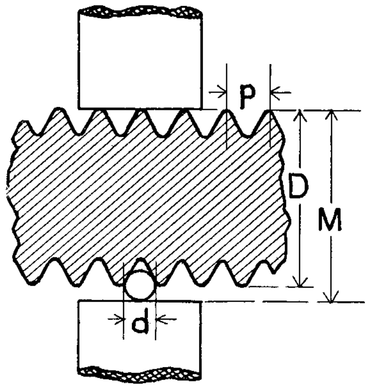
We are not so much concerned here with the methods employed in cutting screws, we believe that nowadays grinding is being increasingly used as a manufacturing method. Whatever method it may be, the final control comes from a carefully cut lead screw and nut. If this lead screw has any inaccuracies, they will show up in the screw that is being cut, and these will be still further magnified by any slackness in the set-up of the change-wheels. Thus we get the effects commonly described as "drunken" threads, that cannot be rectified for accurate work.

The angle of the thread for all Whitworth screws is 55 deg., for ordinary work an allowance of ± 1.5 deg. is permissible for sizes up to $\frac{3}{16}$ in., beyond that size it is ± 1.0 deg. The thread angle affects the pitch diameter considerably, so the precision thread maker will watch the angle of his cutting tools very narrowly, using the handy profile gauges. It may be said that light is the most valuable ally of the

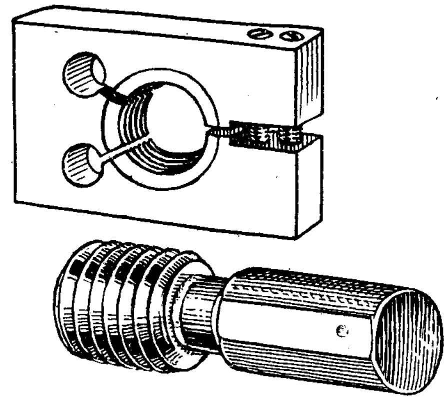
*Continued from page 474, "M.E.," May 9, 1940.



The three-wire method of screw thread measurement.



The single wire method.



Inside and outside reference gauges for screw threads.

man who has to gauge screw threads. The profile gauge is still the best tool to use, though micrometer measurements will tell a story that is unmistakable, as we shall see. Profile gauging is a simple straightforward job that needs no particular remark here, after what we have read in the course of these articles.

The use of the micrometer does call for some remarks, however, for it is not quite so simple as it might appear. We have to check the pitch diameter all along, and if this is found to be constant then everything else will be correct.

There are two methods of doing this, the first is by using a micrometer with specially formed jaws shaped to fit the threads, as shown in the sketch. The point of the moving spindle is rounded off so that it will not run into the bottom of the thread being measured, and the bottom of the V in the anvil is sharp. Thus the gauging surfaces bear only upon the flanks of the thread, and the tool measures half of the depth of the thread from the top on each side. This means that the reading on the scale is equal to the full diameter of the thread less the depth of one thread.

So we have to discover what the depth of the thread ought to be before we start gauging, and this is given by the short formula :

$$\text{Depth of Thread} = \frac{0.6403}{\text{T.P.I.}} \text{ (Whitworth)}$$

For American 60 deg. threads the figure is $\dfrac{0.6495}{\text{T.P.I.}}$

Considering the ¼ in. thread again, we shall find that our caliper reading should be 0.2180 in. at every point of measurement, and if this is so, then the thread is good enough for most purposes.

Ball-pointed micrometer ends were used for this job once, but their record is not true, and these points cannot so easily show up bad threads, places that the V-pointed tool shows up at once. A sketch shows what happens when the gauging points meet such a thread, though we have shown it in an exaggerated form. A thread as bad as this would not necessarily be shown up at all by the ball-pointed tool, for the reason that we have shown in the sketch.

The second method of thread measurement is the wire method. For this it is necessary to provide sets of three wires, ground and lapped with precision to at least ± 0.0001 in. The usual thing is to have the wires about 2/3 of the pitch, though one set of wires should serve for three different threads at least. As a rule, the wires will be finished to exact sizes, such as 0.020 in., 0.025 in., 0.030 in., and so on, though the intermediate 0.005 in. is, perhaps, not so necessary.

There are two applications of the wire method, one in which only one wire is used, and the other in which all three are used. As a drawing shows at a glance what more than a hundred words will explain, here it is pictorially. The lettering is also self-explanatory, we hope. For three-wire measurement of Whitworth threads :—

$$M = D - 1.5155p + 3d$$

Working this out for that ¼ in., 20 threads per inch, and using wires having a diameter of 0.030 in., we get :—

$$M = 0.2500 - \frac{1.5155}{20} + (3 \times 0.03)$$
$$= 0.2643 \text{ in.}$$

So our micrometer should read at every test 0.2643 in.

The formula for British Association threads looks a little more elaborate, though it is only a matter of one more spot of multiplication. Thus :—

$$M = D - 1.7363p + 3.4829d$$

As this standard is based on Metric dimensions it would save a great deal of trouble in measurement if a metric caliper were used. B.A. size 0 is 6 mm. in diameter—that is, 0.2360 in.—and the pitch is 1 mm., 25.4 threads to the inch. You can work out the figures on an inch basis, of course, but metric is better.

When gauging with one wire only, using the jaw of the caliper to bear against the crests of the threads on the other side, the formula takes on a different aspect. Here it is :—

$$M = 1.583d - \frac{0.8004}{\text{T.P.I.}} + \text{Outside Diameter.}$$

Working this out again for the ¼ in. Whitworth, we get ; using a wire of 0.03 in. diameter :—

$$M = 1.583 \times 0.03 - \frac{0.8004}{20} + 0.250$$
$$= 0.2574 \text{ in.}$$

For extreme accuracy of testing, the three-wire method is invariably employed, but for general workshop methods the calipers with the pointed jaws are quite trustworthy. It is necessary to have several of these tools, because the size of the gap and V-point has limits obviously. One will handle threads from 8 to 13, one from 14 to 20 per inch or so on.

Gauging threads from the go or not go aspect is a simple matter, and is carried out just as you would expect it to be done, with a carefully made pair of gauging pieces, a male and female thread that will either go in, or alternatively, accept the manufactured pieces. These gauges are frequently left unhardened, owing to the serious risk of distortion that may occur during the hardening process. Observe the form of the outside type of gauge, with its adjustable feature.

Inside screw gauges are frequently made with the opposite

end in the form of plug gauges of two dimensions, one for the root diameter and the other for the outside diameter.

A device for inspecting the lead and pitch diameter of a screw is also shown here. Three pegs, contoured to fit the thread exactly are screwed to a frame, and the screw under examination must slide in exactly at any part of its length. In the centre, below one of the pegs, is a hardened pad, and a steel plug is provided that must just slide into the gap between the threads on either side, over the pad. Perhaps the sketch will make the idea more clear than the words do.

The idea that absolute accuracy in the working of a screw and nut can only be obtained if they work without any slackness—or backlash—is not necessarily true. If both of the pieces are true as regards their pitch then a certain amount of backlash is quite in order, so long as the last movement in the act of adjustment is in the same direction. We refer now to the use of the screw in measurement, of course.

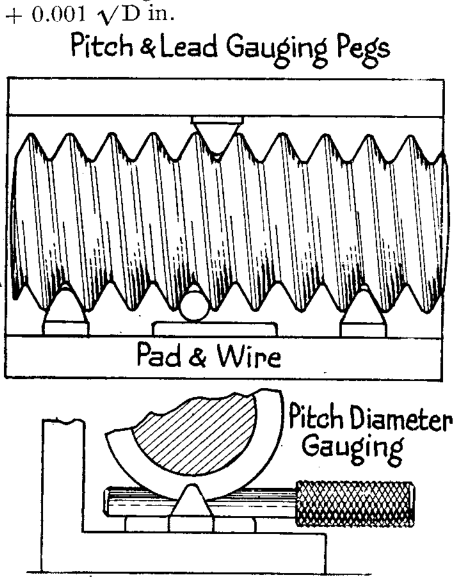
It would be impossible to make a screw work in a nut without some measure of slackness; the English Standard tolerances are as follow :—

On outside diameter of screw — 0.0035 $\sqrt{D}$ in.

On root diameter of screw thread — 0.0045 $\sqrt{D}$ in.

On outside and root diameters of nut + 0.0035 $\sqrt{D}$ in.

Thus we get a tolerance between screw and nut of + 0.001 $\sqrt{D}$ in.



A thread gauging frame.

The profile of the flanks of the screw is of great importance where a free action is wanted, such as with measuring screws, or machinery lead-screws. Magnification shows up defects in a surprising way, and work that looks well finished presents a ragged, unevenness that will take some of the pride out of the workman who thought he knew all about it. This way of examining machine parts is employed to a considerable degree now, especially where a profiled surface may be critically important.

An enlarged drawing is made, showing the true profile that it is intended to make. On to this is projected, by optical means, an image in silhouette of the part as it has been made, and the size of the image is adjusted until it is the same as that of the drawing. The degree of enlargement can be up to 50 times, quite enough to show up irregularities in making.

There is a difficulty about examining a screw thread in this way, because you cannot at any point get a true silhouette of the thread shape; owing to the helical form the actual shape would be thickened up considerably. A remarkable optical system has been invented and developed to deal with this difficulty. A thin sheet of light is projected on to the thread, and a line is thus drawn outlining the profile. This is picked up by another optical system and after being straightened up by its aid is thrown on to a screen, where it can be compared with a scale drawing.

WHY do we do it?

By "Preceptor"

I ONCE showed my first "real" steam engine, under steam, to a friend, and after vainly trying to appear interested, he said, "Very nice. But what is it for? What does it do?" I was very young then, and didn't know the answer, but I must admit that the question was reasonable. We work hard and make sacrifices to obtain our equipment, apparently for the sole purpose of working harder still to create something of no practical value—practical, that is, by hard, materialist standards. I hope no reader will declare that he works for some lofty purpose such as the benefit of mankind by improving valve design, for I should find that hard to believe. Nor do we do it for profit, for once a hobby becomes profitable, it ceases to be a hobby. Nor can I see "L.B.S.C." and his confreres crouching on a flat car for the mere exhilaration of the thing—a bicycle would serve the purpose better.

In almost any creative manual work, the attraction is the pleasure of sensation in manipulating the materials, and the satisfaction rising from the achievement of a desire. The first is generally the lesser pleasure, and is difficult to perceive because we are apt to consider "work" and "pleasure" as opposites. They are not. The hard, physical labour of digging, for instance, can be a very fascinating and soothing occupation—ask any "allotmenteer"! And when there is a nice flat surface to be painted, do you not feel an urge to apply the paint? Children nearly always do, and often that instinct prevails through life. Filing, planing, and forging are similar occupations which attract certain people, just as a child cannot resist moulding plasticene. There is also a pleasure of the senses in certain model engineering processes; there are sights, sounds, and even smells, which give pleasure, for example, in forging, brazing, and turning. The instinct which causes most people to rush off to witness a big fire is similar to that which gives a model engineer an interest in his brazing hearth. It is an instinct for the spectacular.

Every creative worker knows the satisfaction of achievement. "*I* made that. It is the expression of myself in material and I am proud of it," says the craftsman. He is, of course, expressing pride in himself—and rightly so! The majority of model engineers, however, need something more to satisfy their instincts, and that is movement. I have heard of Lascar greasers becoming hypnotised almost to insanity by the jigging eccentrics and the rythmical turn of the cranks. It may be a "traveller's tale," but it illustrates the symptoms. Some minds delight in observing rythmical movement, the more complex the better. To see a wheel revolve gives little pleasure, for the movement is too simple. Add to it a crankshaft, connecting and piston rods, and a couple of eccentrics, and you have something worth watching. That is why most of us make engines, a smaller proportion turbines and electric motors, and fewer still make "glass-case" models. That is why very few model engineers consider making model concrete mixers or hydraulic ramps, or dentist's chairs. "Live-steamers" are more spectacular. Incidentally, I can think of only one mechanical device having what may be termed a strong "spectacular appeal" which has never been described in THE MODEL ENGINEER, and that is the Humphrey's Pump.

It is difficult indeed to understand the complexities of the human mind which cause model engineers to be attracted by that which repels others. To the psychologist, the model engineer mentality is an interesting study, though I doubt if the model engineer can return the compliment—he is usually much too busy for that sort of thing!

*Adapting a Small Lathe for Vertical Milling

By "Ned"

Keep Plates (Fig. 7)

THESE are cut from $\frac{1}{4}$ in. flat mild steel bar to the dimensions stated, and after drilling the countersunk holes for the attachment screws, are placed in position on the ends of their respective slides, which are then marked out and drilled to the tapping size of the screws. After tapping the holes, the plates are attached to the slides, which are then assembled with their mating components and adjusted up by the gibs, so that the tapping holes for the lead screws

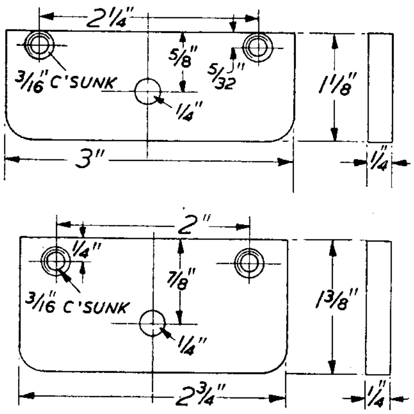


Fig. 7. Keep plates for cross and top slides.

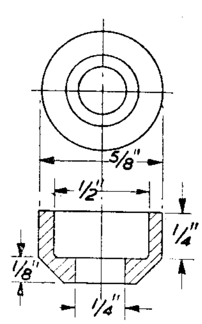


Fig. 9. Index thimble.

may be exactly aligned with the bearing holes in the plates. It is, as a matter of fact, advisable to drill both parts while thus assembled, so that there is no possibility of misalignment; the holes must be exactly parallel with the sliding ways in both planes, in order to ensure that the alignment holds good when the plate is withdrawn from the male slide to the full limit of slide travel. This would not be the case if the screw hole was not perfectly parallel with the slide.

Lead Screws (Fig. 8)

If the task of cutting the square thread lead screws, and making the special tap for dealing with the holes which accommodate them, is considered too formidable, it is possible to employ screws with standard vee threads. The standard $\frac{3}{8}$ in. Whitworth thread (16 t.p.i.) may be used, but this is not very convenient if it is intended to graduate the index thimbles to read in decimal fractions of an inch; as an alternative, $\frac{3}{8}$ in. B.S.F. thread (20 t.p.i.) removes this disadvantage, but involves another, that is, comparative weakness of the thread in the cast iron slides. Traversing the slides is a rather slow process when fine thread lead screws are employed; while this might in some cases be advantageous, by making adjustment more sensitive, there are many occasions when a fairly fast traverse is best. The commonly expressed view that slow traversing is conducive to high finish is by no means invariably true.

Whatever pitch of screw is employed, it is very important that it should be as accurate as possible in all respects. For this reason, the lead screws should be turned between centres and screwcut by the approved methods; the use of dies is not recommended. In the case of square threads, the tool should be ground so that proper clearance on both sides is provided, allowing for the angle of the thread, and it is advisable to make the tool somewhat narrower than the finished width of the groove (0.05 in.) so that side cuts can be taken to finish the surfaces, which have to take the thrust when the screws are in service. If the actual width of the tool point is checked up, it is not difficult to regulate the extent of the side cut so that the proper width of groove is obtained.

The Special Tap

The special tap presents little more difficulty than making the lead screws. It should be made of silver steel, carefully screwcut to match the screws, and afterwards turned on the tops of the threads to a long taper—not less than 2 in.—from core size to full diameter. This ensures that cutting action will be gradual, each tooth taking a very small bite, so that undue force is not required to operate the tap. It is an advantage to turn a pilot at the end of the tap, so as to fit the tapping hole, to provide exact guidance, and thus ensure that the thread is cut truly axial with the latter. The tapping hole should be drilled 9/32 in. dia., but the grooves of the threads should undercut this diameter, so that in no circumstances can the thread bind on the core diameter.

Three or four deep flutes should be cut for the full cutting length of the tap, to well below core depth, and with the cutting edges approximately radial (i.e., with neither positive or negative rake). This operation may be carried out by filing, or any other available method. Finally, each tooth should be backed off by means of a fine file or a carborundum slip.

The hardening and tempering of a long tap demands more than usual care, as it is not easy to obtain a perfectly even temper throughout the full cutting length. It is advisable to first harden the tap right out by heating to a

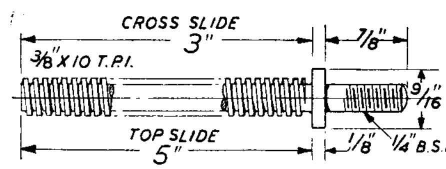


Fig. 8. Lead screws for cross and top slides.

medium bright red and quenching in light oil. Then clean it off thoroughly and polish all readily accessible places. including the shank and pilot. The temper is then "let down" very slowly by heating over a hot plate, or in a sand bath. Do not allow too much heat to reach the cutting edges directly; they may be kept clamped between two soft metal pads to protect them while the two ends are heated. Both the shank and the pilot may be tempered right down to a blue colour, but the cutting edges of the tap should not run beyond a medium straw. Providing that the process is carried out *gradually*, without unduly fierce heat, this object can be attained. The reluctance of

***Continued from page 507, "M.E.," May 23, 1940.**

the centre portion to reach tempering heat under these circumstances can be dealt with by removing the protecting metal and applying more direct heat locally. Finally quench out in cold water.

Index Thimbles (Fig. 9)

These are turned from mild steel to an outside diameter of $\frac{5}{8}$ in., drilled through centrally to $\frac{1}{4}$ in. dia., and counterbored to sufficient depth and diameter to enclose a $\frac{1}{4}$ in. B.S.F. nut, which should lie exactly flush with its surface. While in the lathe chuck, the graduations on the thimble should be incised by means of a point tool held sideways in the tool post, exactly at centre height. Indexing may be carried out by means of a change wheel attached to the lathe mandrel. If the index is intended to read in 1/1,000ths of an inch, 100 graduations will be required (assuming that the lead screw is cut 10 t.p.i.). It is not usual for small lathes to be equipped with a 100-tooth wheel, but most of them have a 50 wheel, which will give 2/1,000ths readings, and it is usually possible to arrange a method of double indexing, using the teeth and the spaces of the wheel alternately, if the finer readings are considered essential. Every fifth mark on the thimble is made longer than the rest, and every tenth mark is given a distinctive sign—preferably by numbering from 0 to 100 by tens.

Before parting off, the back edge of the thimble is bevelled off to approximately 45 degrees. It might in some cases be considered advisable to tap the centre hole, so that the thimble forms an additional lock nut, but in my opinion it is preferable to cut a keyway in it, also to

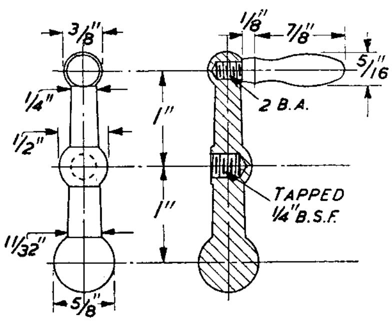


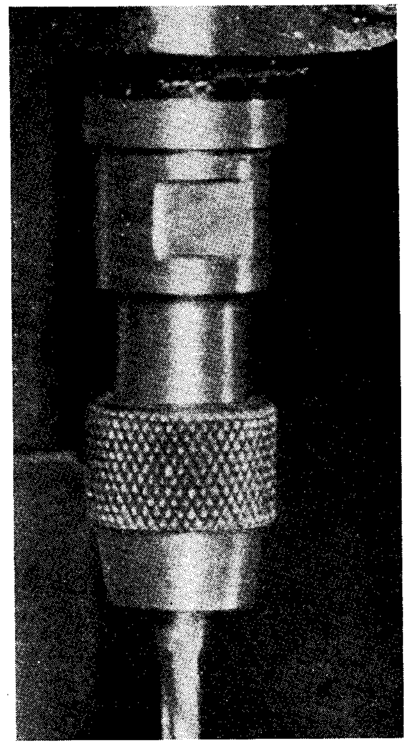
Fig. 10. Details of ball handles.

equip the shank of the screw with a corresponding keyway, so that the thimble would serve as a keep washer, and effectively prevent any tendency for the inner lock nut to slacken off or alter its adjustment under any circumstances.

Ball-Handles (Fig. 10)

The form of operating handle fitted to the lead screws is, of course, optional, but there are at least three concrete advantages in the use of ball handles: they are perhaps the neatest in appearance of any type, they are very handy in use, and last, but not least, they form an interesting and useful exercise in lathecraft. It is not as easy as it looks to make really neat and well finished ball handles, and the turner who can produce them " by eye," without the use of special tools or gauges, can claim to be more than usually proficient. The shapes of the handles on my slides, as seen in photos, may be regarded as experimental.

In quantity production, form tools would almost invariably be used to turn the two components of the handles, but quite apart from the trouble of making special tools for a " two-off " job, there are few model-makers' lathes which would take kindly to a forming operation of this nature. It is best, therefore, to exercise a little manipulative skill in producing the complex shapes, using a combination of hand and slide-rest turning methods.



The simple collet chuck fitted to the milling spindle.

The cross-bar of the handle may be turned from a length of mild steel bar held in the chuck, and projecting far enough for turning the entire component at one setting. The tapered portion can be turned with a fairly narrow round-nosed tool, using the top slide set to the desired angle, which, of course, is not critical to a matter of half a degree or so. At the same time the top diameters of the spherical parts can be turned to size and the shape roughed out by means of the slide-rest tools. These parts are most conveniently shaped by means of hand tools, and the use of a template, or at any rate separate radius gauges, will very much facilitate the task of working them to correct shape. The sphere at the small end can be finished right out and also the central part, but the large end can only be partly machined at this setting, as a stem of not less than about 3/16 in. dia. must be left to support the work. Plenty of cutting lubricant should be used when shaping mild steel by means of hand tools, as this prevents scoring, and enables a high finish to be obtained. After parting off the stem, the job is reversed, and chucked over the centre of the large sphere for shaping up the end to conform with the rest of the surface.

The stalk of the handle is a simpler job which does not call for such precision of shape, but smooth flowing curves and good finish are just as desirable as before. It is best to start with the screwed end outwards, and complete this before dealing with the curves; then shape as much of the latter as possible before parting off, and finally re-chuck to finish off the other end. A round-ended hand tool of fairly large radius will be required to deal with the concave part of the curve. The use of files to shape parts of this nature in the lathe is *not* recommended.

Drilling and Tapping

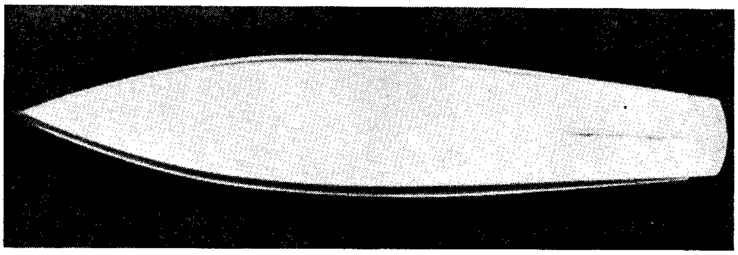
It is now necessary to cross-drill and tap the centre and small end of the cross bar. For the first operation, it should be held endwise in the four-jaw chuck, care being taken to set the centre knuckle to run truly, and the axis of the bar square with the lathe axis. Face off the knuckle, start the hole with a centre drill, then follow up with the tapping drill, which should be put in as far as one dares, short of emerging on the other side. The tap should be held in the tailstock chuck to ensure the thread being perfectly axial.

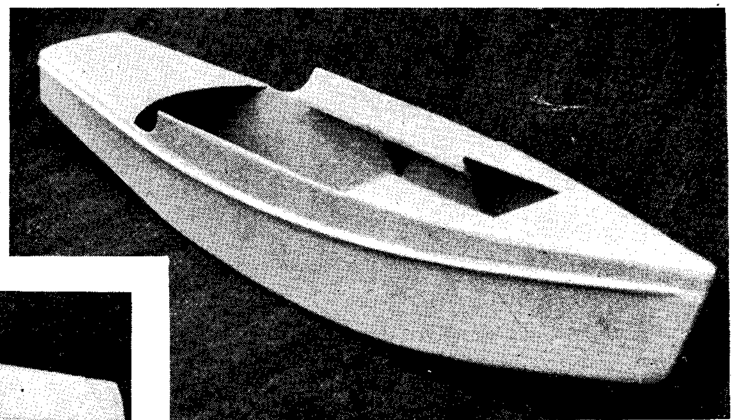
(To be continued)

Easy Hull Construction

Describing a simple method of building hulls, suitable for various types of craft

By William R. Burnett





Left—Underside of hull proportioned to suit most types of power plant.
Above—General view of hull, showing the clean lines.

MANY model engineers possessing the necessary skill to produce a small power plant such as a steam engine and boiler, or a miniature internal combustion unit, often experience difficulty in planning and building a suitable hull in which to instal the machinery.

In a model boat the desirable features are buoyancy, stability and lightness in weight. A perfectly smooth surface also is essential so that " skin friction " in passage through water is reduced to an absolute minimum. A boat built up from metal plates seldom possesses this desirable attribute as the joints and overlaps present an uneven area which causes " drag " when under way.

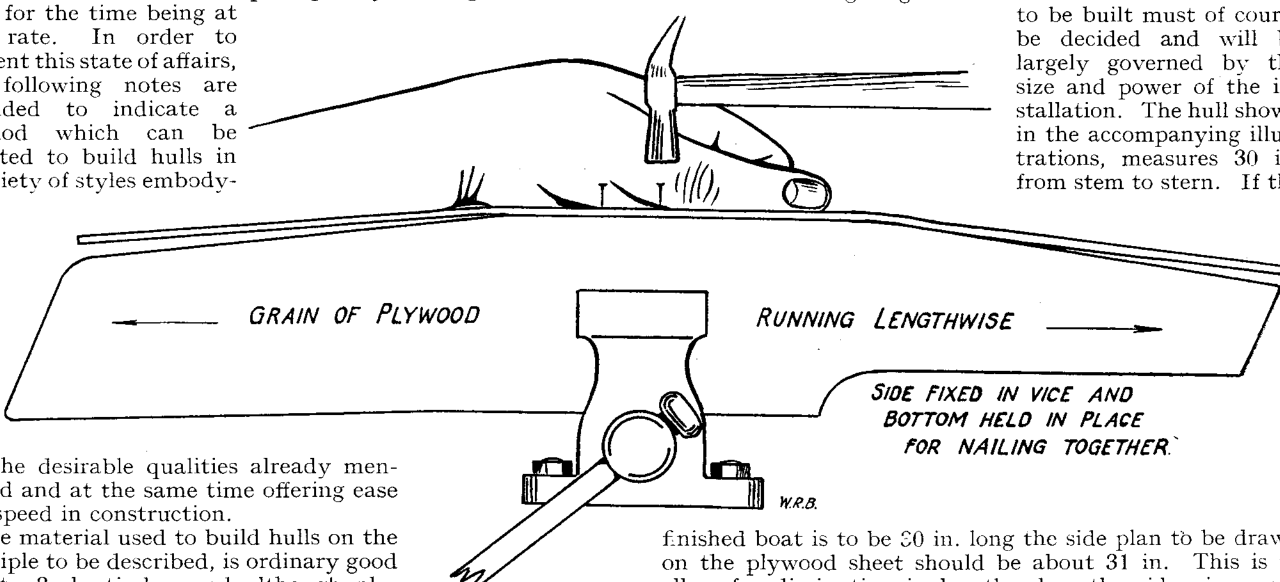
After many months have, perhaps, been spent in completing the power unit, the builder is naturally anxious to see how it performs when fitted into a boat ; and if this is going to take another lengthy period to construct, he is likely to lose interest and, perhaps, lay the engine on one side, for the time being at any rate. In order to prevent this state of affairs, the following notes are intended to indicate a method which can be adopted to build hulls in a variety of styles embodying the desirable qualities already mentioned and at the same time offering ease and speed in construction.

The material used to build hulls on the principle to be described, is ordinary good quality 3-ply timber and although plywood often has been used to fabricate hydroplane floats for racing purposes they are usually of square and angular appearance. For their particular function they are doubtless admirably suited, but many marine modellers require a hull of pleasing lines suitable for a lower power output.

The illustrations herewith show a hull of the motor launch class built up from plywood in the manner to be described. Whilst it possesses no keel plate, this boat can scarcely be described as a flat-bottomed job. The shape has plenty of graceful curves and the degree of lightness and strength is really amazing.

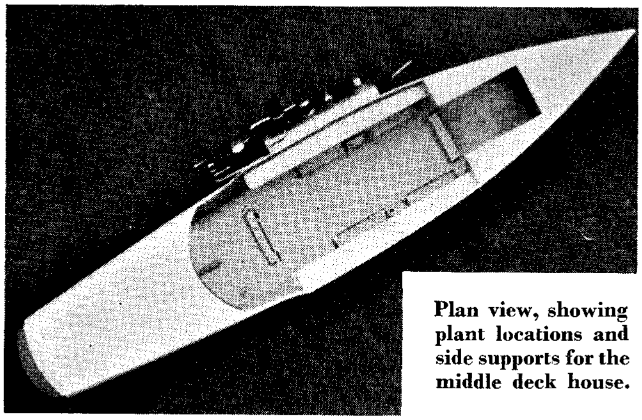
Essentially, the hull consists of four pieces of timber only—not including the decking. A sheet of good quality $\frac{1}{8}$ in. plywood should be obtained, free from imperfections such as knots or coarse-grained patches. Birch is probably the best to use, although alder will doubtless suffice, providing that it has a smooth surface. As a rule, this is cheaper and more easily obtained from the local timber dealer or wood yard.

The side with the best surface should be used for the outside areas of the boat, and a side elevation of the hull should be drawn direct on the board, with the grain of the wood running lengthwise. The dimensions of the hull to be built must of course be decided and will be largely governed by the size and power of the installation. The hull shown in the accompanying illustrations, measures 30 in. from stem to stern. If the finished boat is to be 30 in. long the side plan to be drawn on the plywood sheet should be about 31 in. This is to allow for diminution in length when the side pieces are curved in to the bow and the stern from the full width of the beam. When deciding upon the width, or beam, it is well to remember that the wider the boat the slower it will be. Thus, within limits, it will pay to keep the width down as much as possible ; but there must be sufficient width to ensure stability.



It may be mentioned, as a guide, that the beam at the bottom of the hull should be approximately one sixth of the total length. This may of course vary somewhat according to circumstances and the type of power unit being fitted.

After the side elevation has been drawn out in good black pencil on the plywood, it should be cut out with a fretsaw, and the rough edges lightly smoothed with medium-grade glasspaper. The template, for that is what the first side really is now, should be laid down again on the plywood, and a good line drawn round its edge so that an outline of the same size and shape is left for cutting to. When the second piece is ready, the bottom will be the next to receive attention. The widest part of the bottom of the hull shown, is 5 inches. This may be taken as a guide in drawing out the bottom plan of the hull. In order to get the plan



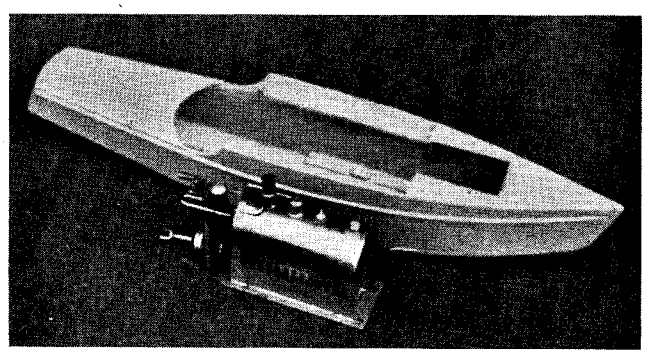
Plan view, showing plant locations and side supports for the middle deck house.

properly balanced it is perhaps as well first to draw it as a half on a stout piece of paper correctly folded down the middle so that when opened out it forms a properly balanced plan. It should be mentioned here that it will be better to cut the bottom piece of plywood with the grain running across the width, to permit the bottom to bend more easily to the well-curved contour of the underside from stem to stern. It would not be nearly so easy if the grain ran the full length in this case. We now have the three main pieces of timber which form the hull, and they can now be prepared for assembly. The first consideration is the prow. In order to secure a finely-pointed bow, it will be necessary to chamfer off to a suitable angle the inside edges where they meet so that when in close contact the final knife edge of the prow will be about 1/16 in. wide.

When this has been satisfactorily accomplished with a small plane, and before doing anything further to the prow, one side can be got ready for fixing to the bottom plate. This may seem rather awkward at first, as the two pieces being fairly flexible, appear somewhat troublesome to keep in position. The best method, however, is to clamp the side first being fitted, bottom upwards in the vice so that the centre comes between the vice jaws. The wood should be protected with pieces of cardboard or waste plywood to prevent damage. The whole edge should be coated with a suitable glue such as is supplied by model aeroplane accessory firms (not celluloid) in tubes.

The inside edge of the bottom piece should also be coated with glue. This particular kind of adhesive is immensely strong, but as a rule needs warming slightly, to cause it to run freely and penetrate well into the fibres of the wood. The bottom piece of plywood should be held in place at a slight angle—to give an upward taper to the sides—whilst a few thin model aeroplane nails are driven in with a light tack hammer. Nails should be spaced about $\frac{3}{4}$ in. apart, and should be $\frac{3}{8}$ in. long. Any model aircraft stores will supply them as well as the necessary glue. Every care must be taken to see that the tiny nails enter squarely and truly so that they do not come out at the sides anywhere. When the nails have been put in at the centre for an inch or two, the side of the hull should be released from the vice and slipped along so that another lot of nails may be inserted. It does not matter whether one works towards the prow or the stern, but the nailing must be continued until the bottom piece is secured in position over the entire length, when the first side and the bottom may be removed from the vice. Before the glue of the first side is set, the other side should be fitted in a similar manner. When the two sides and bottom are united it remains to join up the chamfered ends of the side pieces at the prow. Glue should be applied to the inner surfaces and the hull laid sideways on the bench with the stern raised to bring side of the prow in contact with the bench top. A few of the thin aero nails should be driven in, also a few in a like manner from the reverse side. Ends of the nails should not be clinched over, but should be nipped off with a pair of pliers and left for subsequent filing down. A three-cornered strip of wood should be pressed in and well glued at the inside joint of the prow. Leave all edges of hull rough, for time being, until the glue has thoroughly hardened and set. Next, cut and fit the stern piece, which can be simply a piece of ply-wood placed straight across the stern, but a better appearance is given if it is curved as shown in our illustration.

Some may prefer to cut the stern piece from fairly thick wood, shaping it as required. This method makes a strong job and is quite satisfactory. We now have the hull complete in the rough, except for decking. It should be left in a warm room to dry out completely, but a couple of temporary struts should be placed across the widest parts to preserve the necessary side taper down to the bottom,



Top and side view of hull with self-contained steam plant ready to drop into place.

during the drying out process. These need not be secured in any way, the natural spring of the sides being sufficient to keep them in position.

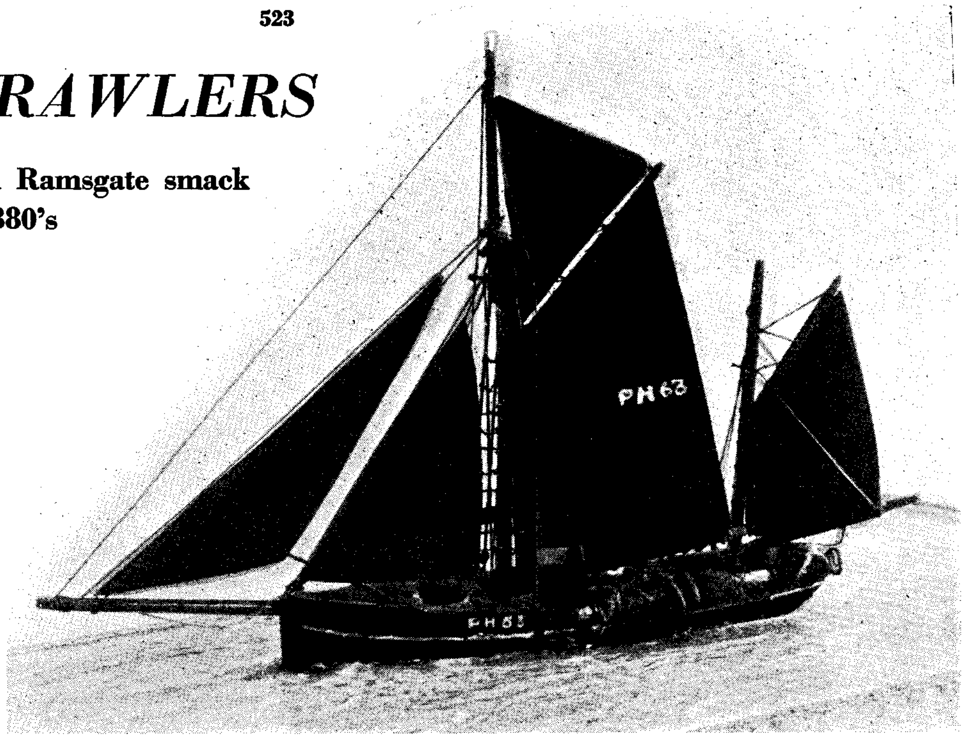
The kind of fixed decking needed must now be decided and will have to be arranged with due regard to accessibility of the working parts. But the fore and aft deck arrangements used on the hull here will give a good idea of what is needed to ensure strength and rigidity in the completed hull. Before fitting the decks, cross beams should be fixed beneath them as near to the open portion as possible. These beams need only be light pine or deal, $\frac{3}{8}$ in. $\times$ $\frac{1}{4}$ in. section. They are best placed across in a verticle position to ensure solidity, and may be kept in place with two nails driven through the side of the hull at each end. When the beams are in position the decking can be nailed down in the same manner as the rest of the work.

(To be continued.)

*SAILING TRAWLERS

How to make a model Ramsgate smack of the 1880's

By
E. J. March,
M.S.N.R.



FROM September to May the smacks often worked alone, being at sea from 10 to 14 days. Winter was the great trawling-time, as there was always plenty of wind. The master and crew were all paid on the sharing system—except London smacks, which paid regular wages, averaging about £1 a week for each member of crew.

In the Channel, sail was still employed long after 1902. Brixham had a fleet of 140 large and 160 small trawlers up to 1914, and the industry employed over 1,600 men. Seventy-four smacks were lost in the Great War; on one day alone, in 1917, eleven, valued at over £12,000, were sunk by gunfire from a U-boat. After the war some new ketches, costing over £2,000, were built up to 1926, when a rapid decline set in, only 80 fishing in 1930, 30 in 1933 and 5 in 1938.

Ramsgate had 180, falling to 150. About 50 were lost by enemy action during the war, and in 1922 only 25 survived, and ten years later one solitary smack, *Quartette*, was working.

Method of Fishing

The beam was 36 to 50 ft. long, usually of elm, natural-grown timbers scarfed together. The length was determined by the distance between taffrail and aft shrouds. At either end were the head-irons, which raised the beam and back of the net about three feet from the ground. These weighed 230 to 360 lb. at Brixham, 360 to 400 lb. at Grimsby. The trawl was a triangular purse-shaped net, with the lower margin fastened to the ground-rope. The net tapered to the "cod," a narrow bag about one-seventh of the length of the trawl. The cod end was closed by a rope, which was cast off when the net was hoisted on board, and the fish fell out on the deck. Two bridles about 15 fathoms long were secured to the front of the head-irons, and a warp about 150 fathoms of 6 in. rope was shackled to the span. The gear cost £70 to £80 for a double set, and a net lasted two to four months; to renew a hemp-net cost about £9, and a manilla one about £16.

Smacks trawled with the tide a little faster than the stream, and kept the net down about five to six hours. Brixham towed with warp over the bows, North Sea from roller port on port side. In the early days the trawl was hauled in by handwinch or capstan, a long wearisome job.

Continued from page 497, "M.E.," May 23, 1940.

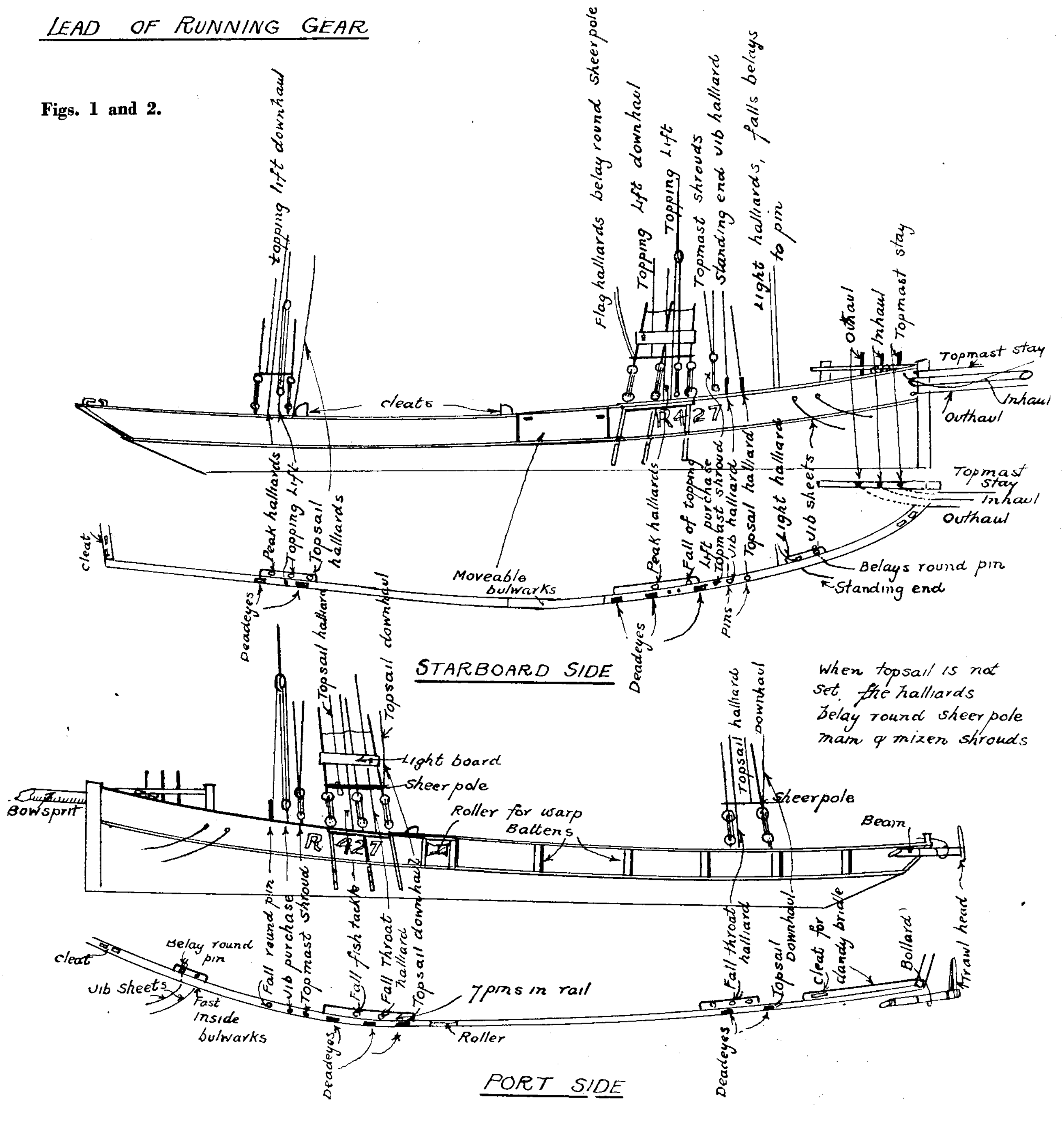
In 1880 steam capstans were introduced at Grimsby, and other ports rapidly followed suit. Later, nearly all heavy work on board, such as setting sails, running out the bowsprit, and even reefing, was done by steam. Trawling was usually done on the port tack, thole-pins on the gunwale preventing the warp slipping forward; and, by adjusting their position according to wind, the smack would sail herself. Speed of eight or nine knots was reduced to one and one and a half knots owing to resistance of the trawl. One hand remained on deck whilst the rest went below.

Type

Generally speaking, all trawlers ran true to type—ketch rig—but each port had local characteristics which instantly identified the smacks. Brixham and Plymouth has the foremast stepped farther aft than the others, which made a striking difference in size and angle of foresail; and they usually set an enormous balloon foresail, sheeting home amidships, when the trawl was down. Ramsgate smacks were generally smaller and had less lofty rig than Lowestoft, and in later days often had no cross-trees. Lowestoft had the mizen about the same height as the lower main mast, and frequently set a mizen staysail with a beam wind; their gaffs were as long as the booms, and the jaws were rather low. Grimsby smacks had jumper-stay on mizen, Hull had none, and both were largest types 70 to 90 Tons NM. Scarborough favoured reef points instead of lacings.

The photographs show a model of a Plymouth trawler, PH 63, which I made some years ago, actually the second miniature I tackled. The hull is only 3 in. overall, so that the model is much smaller than plans shown for Ramsgate smack, yet it is rigged and fitted with all details described. Rigging shows up heavier in photos. than in model owing to shadows thrown. I clove-hitched all ratlines to shrouds instead of glueing them across as in later models; one learns by experience and latter makes a better and neater job. A jib stay is fitted instead of jib being set flying, and no mizen topsail is set.

Figs. 1 and 2.

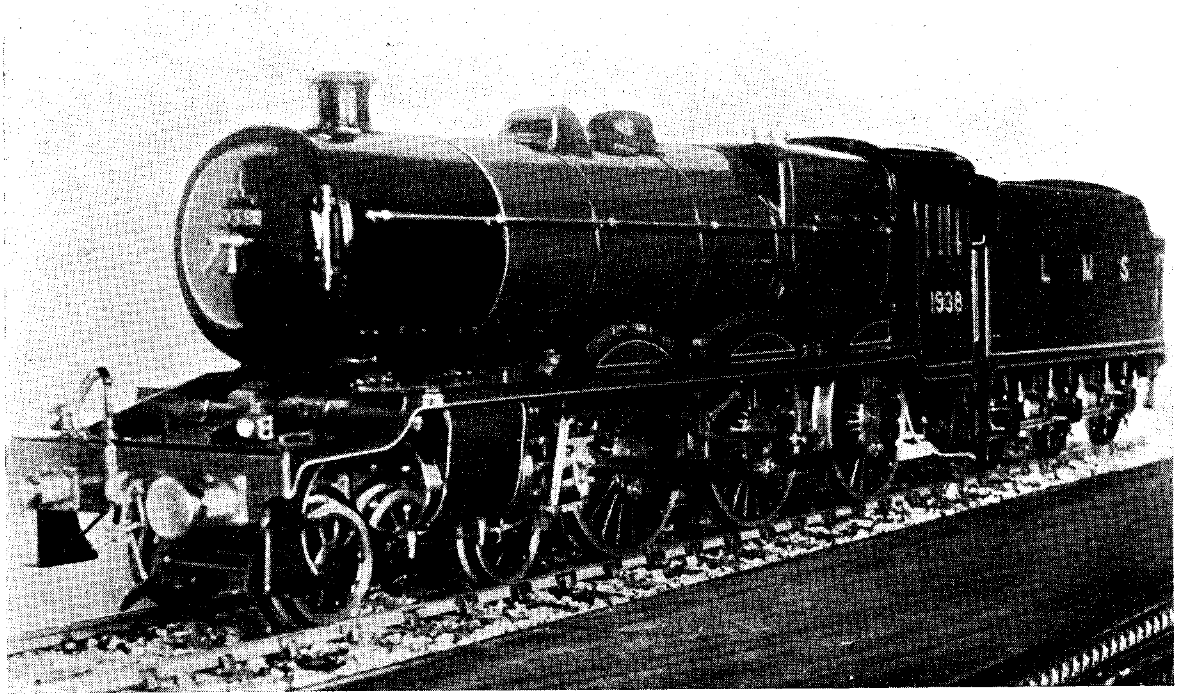


The Model

I have chosen a typical Ramsgate smack of the 1880's for our model, and she makes a delightful subject. These trawlers were magnificent sea-boats, able to face any weather, with plenty of sheer, high straight bows and rockered keel. The forefoot was curved, and tended to get more and more rounded in later vessels; and the large rudder fitted just before the Great War made them handle beautifully, for they were able to sail round and round a buoy whilst waiting to leave harbour. That they were fast is shown by the fact that *Quartette*, the fourth built from the same lines—hence the name—did the trip from her builders at Dartmouth to Ramsgate in 25 hours in 1896.

In the palmy days the sail plan was elaborate, with big jack yard topsails on main and mizen, and jib topsail. The latter sail was used when making a passage, and was a frequent cause of broken topmasts. When shortage of men began to be felt, they were scrapped and a smaller jib-headed topsail set on main and a larger mizen with no topsail. Three reef cringles in leech of main and mizen, with eyelets and lacing for reefing instead of reef points.

(To be continued)



*"Highland Chieftain"—By William M. Hunter

A ½-in. scale free-lance 4-6-0 locomotive

THE tender frames were marked off on 1/16 in. steel plate to the dimensions shown on the drawing, and cut out. Short lengths of ⅜ in. angle were riveted to the ends of each frame inside and outside to take the buffer beams. The frames were then set up after the manner prescribed for the engine and the rivet holes marked off on the front and rear beams. When drilled, the frames were assembled with 3/32 in. rivets.

The frame stays between the wheels were bent from 1/32 in. steel plate and silver-soldered at the corners. The stays are 3⅛ in. long × 13/16 in. × ¼ in. A 5/16 in. hole was drilled at a centre 7/16 in. from either end, and an elongated hole 5/16 in. × 1 in. was cut out in the centre. These stays were secured to the frames by two 1/16 in. rivets through each end flange.

The horns were cut from ⅜ in. brass angle and held to the frame by four 1/16 in. rivets, and two small triangular pieces of 22 s.w.g. sheet brass were soldered in position on each horn to give the appearace of castings.

The horn keeps were made from pieces of 3/16 in. × 1/16 in. steel strip 1¼ in. long, and were secured to the frames by means of a 1/16 in. bolt and nut at either end.

A pattern was made for the axleboxes, and castings were obtained in gunmetal. After these were fitted to the horns, a 3/16 in. hole for the axle was drilled ⅜ in. deep from the inside face on the centre of each box. A 1/16 in. hole for lubrication purposes was then drilled diagonally from the top of the box into the centre of the axle journal, and an ⅛ in. hole, ⅛ in. deep into the boss on the top of the box, this to serve as a bearing for the thimble of the spring buckle.

A pattern was also made for the springs which are of laminated appearance. In each case a 9/64 in. hole was drilled in the buckle from the bottom side, and into this an ⅛ in. diameter spiral spring was fitted. Short pieces of ⅛ in. rod were cut for fitting between boxes and springs. The extremeties of the castings were drilled for the spring hangers. These were made from pieces of 1/16 in. rustless steel about 1⅛ in. long screwed at either end. The spring hanger brackets were cut from ¼ in. brass angle and each secured to the frame by two 1/16 in. rivets. A piece of rubber hose was cut in sections ⅛ in. long, and each section fitted between two thin 1/16 in. washers, then secured to the spring hanger by a 1/16 in. nut.

The wheels and axles were machined as previously described for the bogie wheels, but it must be understood that in this case the journals extend beyond the outside boss of the wheels.

A ¼ in. brass angle was fixed along the top edge of the frames by 1/16 in. rivets 1¼ in. pitch, to provide a landing for the tank and a means of securing this to the frame.

The tank was made from 22 s.w.g. sheet copper and soldered throughout; ¼ in. brass angles were sweated in position at the corners and along the top and bottom edges on the inside of the tank. The side plates were bent over in the usual manner to comply with the loading gauge, and a cope iron was soldered along the edge, flattened 1/16 in. copper wire being used for this purpose. Prior to the top of the bunker being soldered in position, five holes for No. 6BA screws were drilled in the frame angle, then corresponding holes drilled in the bottom of the tank. Brass screws were inserted in the latter and sweated in position. The top of the tender at the back of the coal bunker forms a separate part and is secured to the angles by 1/16 in. brass bolts and nuts, this to assist in removal of pump, sieve, etc.

**Continued from page* 488, *"M.E.," May* 16, 1940.

The front plate of the bunker is checked out in a Vee shape and fits into slides similar to those on the cab roof. It can be removed completely, thereby enabling the driver to obtain better control of the shovel when firing.

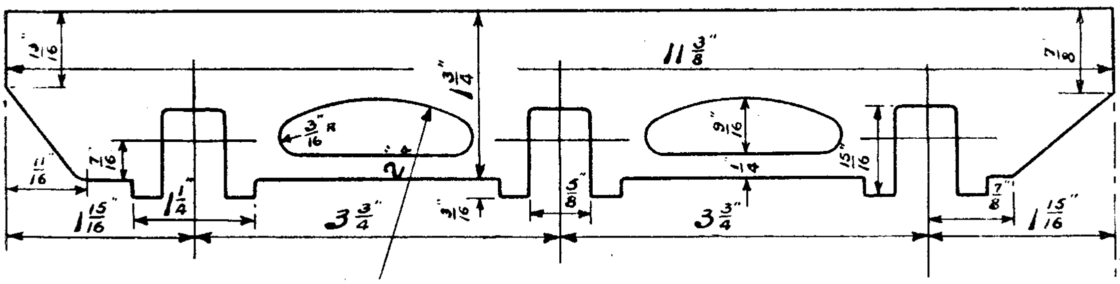
A vertical ram pump is fitted inside the tender tank. The knurled handle for the ram is concealed underneath the dome cover of the water pick-up gear.

Springs and spring hangers were fitted in position and secured by means of a nut on top of the spring wings. The tender was then wheeled and the horn keeps fitted in position.

The brake gear, draw gear, buffers, hose connections and lamps, etc., etc., were finished off in the usual manner.

Painting

The painting of a model is often a source of worry to model engineers, many of whom, though highly skilled workers with metal, find the finishing operation nothing short of a nightmare. Certainly, after great pains have been taken in producing a smooth finish on the metal work, it is regrettable that the super detail should be clogged with some unsuitable paint, or even good paint copiously applied.



Dimensioned details of the frames for the tender.

The author has tried several brands of paint, but, without exception, has found it most beneficial to pass the best qualities through a fine muslin sieve. As regards brushes, a ½ in. flat sable hair brush has been found most useful for painting 2½ in. gauge models. Fine round pencil brushes ranging from 1/32 in.—3/16 in. are, of course, necessary for dealing with several details.

Referring to the model described, the boiler was painted and varnished before being finally fitted. This item, however, and other details were first washed with turpentine in order to remove any grease. This was done with a brush, a piece of clean cloth being used for final wiping off. A word of caution here might also be useful, *viz.*, the hands must not be rubbed over any copper parts after such parts have been washed and dried, as the greasy film deposited will prevent the paint from drying.

As for actual coating, the procedure outlined hereunder will be found successful. Apply a coat of flat brown or grey paint and when thoroughly dry, rub this down very lightly with fine sandpaper. An exceedingly fine grade of this material is known as "wet and dry" paper, and should be used with water. This paper has been found most satisfactory. After the rubbing down process is completed, apply a coat of flat crimson lake colour, and rub down in the same manner. Add to the lake colour about 1/3 of the quantity of copal varnish. Mix the colour and varnish well together and apply as a third coat. The coats as they are laid on should be quite thin to obviate curtains or waves during drying off.

At this stage, the lining and fixing of transfers should be carried out. The width of the black and yellow lining on standard engines is approximately 1⅛ in. and ⅜ in. respectively. On a ½ in. scale model the width of these lines should, therefore, be in the region of 3/64 in. and 1/64 in. Also, as several fine models have been ruined in appearance due to excessive breadth and boldness of lining, it is recommended that the sizes should be adhered to as closely as possible.

The black lines can be applied with a small round brush. With the engine tilted up on one side and the weight of the hand resting on a small perch (resting against the job) or on the back of the left hand—after the manner of a sign writer—a reasonably good edge line can be painted. The application of a very fine yellow line is best effected by the use of a drawing pen and pen compasses. So that the curves may be drawn without damage to the adjacent paint work, a small piece of timber about 1/16 in. thick should be employed to hold the point of the compasses. The curves can be linked up by the use of a drawing pen and straight-edge. The lining colours should be in flat paint of fine consistency. In the first place, of course, the blades of the pen must be clean, and in case any difficulty might later be experienced in getting the paint to flow, a small brush along with a little turpentine should be kept within easy reach. The inside of the blades can thus, if necessary, be moistened with turpentine. Incidentally, an easy and efficient method of loading the pen is to apply a drop of paint by means of a small stick or brush.

Lettering

Transfers of letters and numbers for 2½ in. gauge models and upwards are not easily obtained, but gold transfer paper or leaf can be procured at the majority of oil stores.

If this is employed, the following method will prove effective. On the back of the transfer paper mark off the block letters and numbers required and cut these out with a sharp penknife or scissors. Next, rub chalk on to a piece of linen thread and spring the latter against the cab or tender for location of the different letters. Apply a coat of gold size to the transfers, then place them in position and leave for about an hour or so, after which they should be quite dry. Next, damp the back of the transfer, using a sponge and cold water, and the paper backing will peel off leaving the transfer in position.

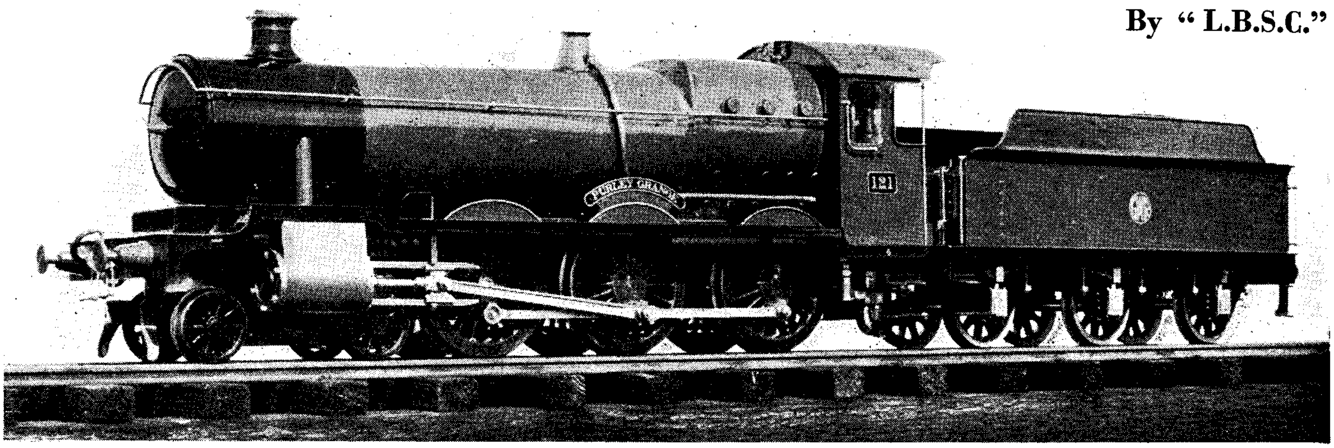
For the model under discussion the shading of the letters is shown at 45° to the right-hand side and bottom edges, and is in bright vermillion. These can be lined in with a pen and painted in with a small brush. The width of the bars of the letters is about 1/6th of the actual height, and the shading is about 2/3rds of the width.

After all marking is completed, the model is ready for finishing off, which is best accomplished by the application of two coats of the best copal varnish, care being taken not to work the brush excessively. To guard against the tendency of the varnish to run, these coats must be thin and even.

In conclusion, it is the author's sincere hope that the foregoing description and illustrations may be of service to further the cause of model engineering among loco. enthusiasts, also that the experiences referred to may create a desire within others to describe their work and explain their difficulties so that all may benefit thereby.

"PURLEY GRANGE" LEAVES THE SHOPS

By "L.B.S.C."



SOME little while ago I promised some pictures of the experimental "Purley Grange" when completed, and here they are, thanks to our friend, Mr. Grose. The engine was finally finished off during the last week in April, and on the "pass-for-service" trial run, travelled a distance of 2¼ miles with only one stop to refill the tender and lubricator. Hauling my weight, with the lever just off middle, and the regulator half open, she maintained a steady speed equal to ninety miles per hour, for the whole of the distance; the fuel and water consumption was remarkably low. Incidentally, this will probably be the last 2½ in. gauge engine I shall personally fit with a feed pump of what hitherto has been my "standard" bore and stroke, viz.: 5/16 in. by ⅜ in., as I find it unnecessary. On the run above mentioned, the bypass was open fully all the time. The delivery pipe to the top feed is 5/32 in. diameter, and the bypass pipe ⅛ in. diameter. I found that with the small driving wheels and the high speed, the bypass pipe would not take all the water back to the tender, and the excess delivered by the pump was very nearly sufficient for the needs of the boiler. The water sank in the glass very slowly indeed, as the engine "pursued its effortless course," as the poet might put it; and when the water dropped below half a glass, I put the injector on and filled it up again.

Pumps

The bypass valve on "Purley Grange" is a screw-down affair with a cross handle, and it is easy enough to throttle the bypassed water so that a constant level is maintained in the boiler. However, there is no sense in fitting a big pump which spends best part of its time, and mops up useful energy, in merely circulating water round and around. If you reverse "Purley Grange," and just crack the throttle so that she pushes the car very slowly and gently, the resistance of the pump on the forcing stroke can be distinctly felt. Old "Ayesha" has been running for a long time now, with a pump only 6 mm. bore, and this will keep up the water with a three-passenger load, though the old girl still only has loose eccentric valve gear which cuts off at between 60 and 65 per cent. Judging by this, and by the performance of "Purley Grange," a pump say ¼ in. by 5/16 in., or 7/32 in. by ⅜ in., should be quite sufficient for normal loads and speeds, *provided the valve gear is properly timed and fitted*—most important that!—and nothing blowing past the pistons. Any sudden extra demands for steam, and consequently water, due to a succession of stops and restarts with a big load, climbing a long bank, and so on, can always be met by an application of the injector. However, it might be as well if beginners and inexperienced locomotive builders continued to fit the 5/16 in. by ⅜ in. pumps to 2½ in. gauge engines, as it gives ample reserve to maintain the level on an engine which (like most "first attempts") is not economical in steam consumption.

The Final Stages

Here are a few notes supplementary to the general description of the job published in April 11th issue. The superstructure, or "top works" of the engine, are made from 20 gauge hard-rolled brass throughout, all the cutting-out being done on my Driver jig-saw, which proved an invaluable time-saver, especially on jobs like the opening for boiler in the cab front. In the ordinary course of events, this entails drilling about a million little holes (eh? no, I did *not* count them, but by the time anybody reaches the last one, the number mentioned seems to be about the correct estimate!) and chiselling out the piece. The ragged edges have then to be filed and fitted to the firebox casing. The procedure with the Driver saw is simplicity itself. The former-plate used for flanging the backhead, is necessarily the correct contour of the opening, allowance being made for thickness of backhead flange and firebox wrapper, when marking out the opening in the cab front and using the former-plate as guide for the scriber. The cab front is then placed on the jig-saw table, and manoeuvred around against the moving sawblade, so that the latter cuts exactly along the scribed outline of the firebox casing. The opening left by the saw, fits the casing correctly, and the cut is so clean that hardly any cleaning up with a file is required.

Each side of the running board, complete with splashers, and the "air-raid shelter" covering the pendulum levers, was made up as a single unit. The straight part of the edging is angle-brass; the curved section at the front end was cut from 16 gauge sheet, to correct shape, on the jig-saw, which was also responsible for the wheel clearances, etc., in the running boards. Each unit is attached to the top of buffer-beams, and is supported by the guide-yoke and small brackets attached to frames between the coupled wheels. The whole lot can be taken off in a couple of minutes or so, if required in emergency. The box-like front section had to be made that shape, to clear the mechanical lubricator, and is instantly removable for filling same.

The chimney was turned from a stub end of copper tube as used for large hydraulic presses, 1⅜ in. outside diameter

and ⅜ in. in the bore. The size and shape is according to the G.W.R. drawing. The safety-valve casing is turned from solid, no auxiliary covers being provided for the top-feed fittings. The cab windows are " glazed " with mica, and the arrangement of the " handles " is shown in the photograph of the interior. The hand-pump clack tucks away nicely between the cab side and the wrapper, and the valve wheels are all easily accessible. Inspector Meticulous and Co. will probably raise wholesale lamentations about the absence of a little curved plate, with a slot in it in which works a pin connection, above the regulator handle, which is found on full-sized Great Western engines. Well, if the latter had mechanical lubrication, same as this one, that gadget would be missing on those as well, as it is only needed in connection with hydrostatic lubrication. I did have in mind, fitting it and connecting it up to a separate valve which would automatically put the blower on when the regulator was shut, but came to the conclusion that it was not worth the trouble. The regulator itself, by the way, is a disc valve with pilot port taking steam from the front end of the Belpaire casing—and does *not* leak !

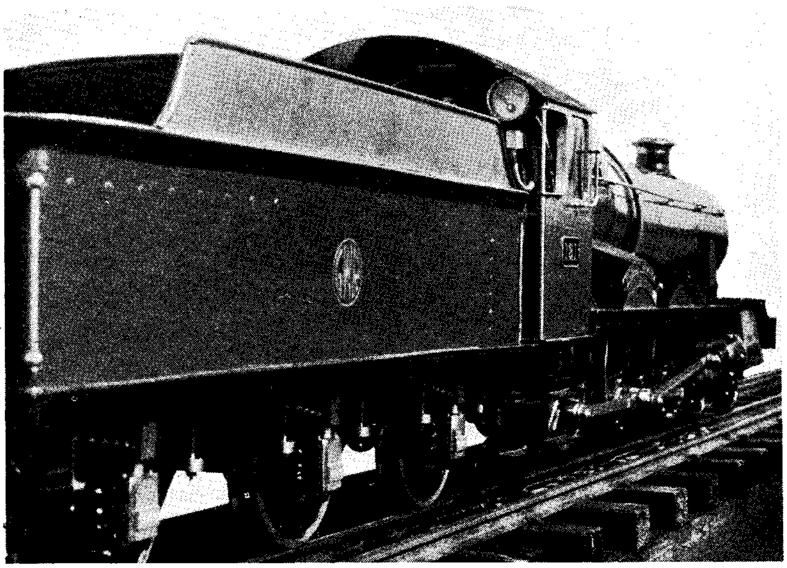


Photo by] **A realistic shot. Note working leaf springs.** [*C. J. Grose.*

Tender

This was made according to my usual practice as given in the " Live Steam " notes, but the dimensions were taken from the outline drawing given in the *Great Western Magazine* which shows a tender of larger capacity than the older type in the illustration of the first " Grange " class engine in the same issue. No angles were, however, used for attaching frames to buffer beams, the frames being fitted tightly into the slots, and the whole lot fixed with " Sifbronze." The horns are separate, and made from angle brass, riveted to the frames. The axleboxes were milled out of ½ in. square solid brass bar, the fronts being milled up to the Great Western shape (see photo), and the Company's initials put on with letter punches. Working leaf springs are fitted, and making them up was a good test of patience, I assure you. They are built up on Mr. Glazebrook's principle, each " plate " consisting of three separate laminations, and there are a total of 108 plates in the set. The hoops were made by channelling out a piece of 5/16 in. square steel bar on the milling machine, brazing a strip over the channel to form a rectangular tube, and then parting off the hoops in the four-jaw. The pads under the hoops have screwed stems which pass through the bottoms of the hoops, and clamp each set of plates in position. The hangers are 15 gauge spoke wire, passing through clearing holes in the top spring plates, and tapped holes in the brackets, which are made from ¼ in. by ⅛ in. steel, with turned stems passing through holes in the frame, and nutted on the inside. Nuts are fitted at top and bottom. The trouble taken in making up these working leaf springs, was well repaid in the perfect action when running, and the realistic appearance.

The soleplate is 16 gauge hard-rolled brass, and the sides and back 20 gauge ditto. The latter are all in one piece ; and if anybody who reads this, has ever tried to flange out the corners of a rounded coping in *hard* brass without splitting it or showing hammer marks, he has my sincere sympathy. Anyway, I am going to rig up some sort of a press-tool gadget for another similar tender to be put in hand ! The inside of the tender calls for no comment, except that the tank stops short of the front plate by an inch, leaving a large space for coal ; and the dome, which in full size covers the top of the pipe leading from the water scoop, is made removable, and conceals the operating end of the emergency hand pump, also affords a fine big hole for filling up the tank. The *ersatz* water scoop handle, which is used to operate the injector water valve, can be seen in the opening between cab and tender in the full view of the engine. As the tender tool-boxes were a confounded nuisance when driving and firing the engine from the flat car, I made them detachable. They just slip on to the front plate of the tender, and can be taken right off when running.

Painting and Decorating

The locomotive is painted with " Sol " synthetic hard gloss, and any oil or dirty water splashes can be wiped off the boiler with an oily rag, which immediately restores its pristine beauty. A friend of Mr. C. B. Williamson engraved the number and name plates, and your humble servant was responsible for the monograms on the sides of the tender. I scratched them out with a scriber, in the green paint. Well, so much for my experimental engine. Mr. J. N. Maskelyne once said, that the test of realism in a little engine, was to take a photo of it and compare with full size. Little " Purley Grange " is not intended to be an exact copy of her big sisters ; but she *looks* Great Western, and she certainly *goes* Great Western. Furthermore, you can put the pump or injector on when she is running fast and blowing off, and fill her well above the top nut, through the top feeds, without a drop of water coming from either safety valve or chimney—and *that* is Great Western, too !

THE " BAT "

Backhead Fittings

In this size engine we are properly up against it in the matter of backhead fittings that are small enough to go into the cab, and yet large enough to do their appointed job. To begin with, there is only 3/16 in. bare headroom over the firebox wrapper below the cab roof, which is not enough for a two-union turret, so we are faced with two alternatives : either to use a plain plug 3/16 in. high, with two ⅛ in. pipes silver-soldered into it, screwed into the boiler through the backhead flange, and bend the pipes to suit blower valve and steam gauge connections after screwing home ; or else to use two separate elbows with unions, screwed into the boiler as near the top as possible, without hitting the cab roof.

The blower valve is a reduced copy of those fitted to $2\frac{1}{2}$ in. gauge and larger engines, and has a 3/32 in. pin. No detailed instructions are needed for making either this, the water gauge, or the clack box, as they differ only in size, from those I have fully described from time to time. The firehole door is just a plain oval of sheet metal; no baffle plate or catch is needed. The hinge should not work too freely, so that the door will remain of its own accord where placed. When all the fittings are on, the boiler can be given a steam test with a Bunsen burner or a spirit lamp under the firebox. The above remarks apply to both loco-type and water-tube boilers, except that no gauge glass will be needed on the latter.

How to Mount the Boiler

This job is soon done. The smokebox of the loco-type boiler rests on the frames, and the bottom of the boiler merely needs to be set parallel to the top of frames. To fix the rear end, make two little links of sheet metal, and rivet one end of each to the projecting part of the inner firebox, bending it outwards to meet the frame at either side. When the boiler is adjusted at correct height, a screw is put clean through frame and link at each side, and secured with a nut. These links allow for the expansion of the boiler, but prevent it from lifting. The water-tube boiler is attached in a very similar manner. Drop the bottom edges of smokebox wrapper between the frames at the front end, and adjust the boiler to correct height. Put a single screw (8 or 9 B.A.) through the frames and wrapper at each side, just ahead of the cylinders. At the rear end, fix a couple of sheet-metal links as above, but attach them to the sides of the firebox casing, on the inside.

The smokebox connections can then be made; couple up the union on the superheater to the steam fitting, and set the blast pipe centrally with the chimney, adjusting the blower jet as near the blast pipe nozzle as possible, so that the jet of steam goes up the liner. Plug up any interstices in the bottom of the smokebox, either with plumbers' jointing, or if too large for that, with "putty" made by kneading up scraps of asbestos millboard or sheet jointing, with water.

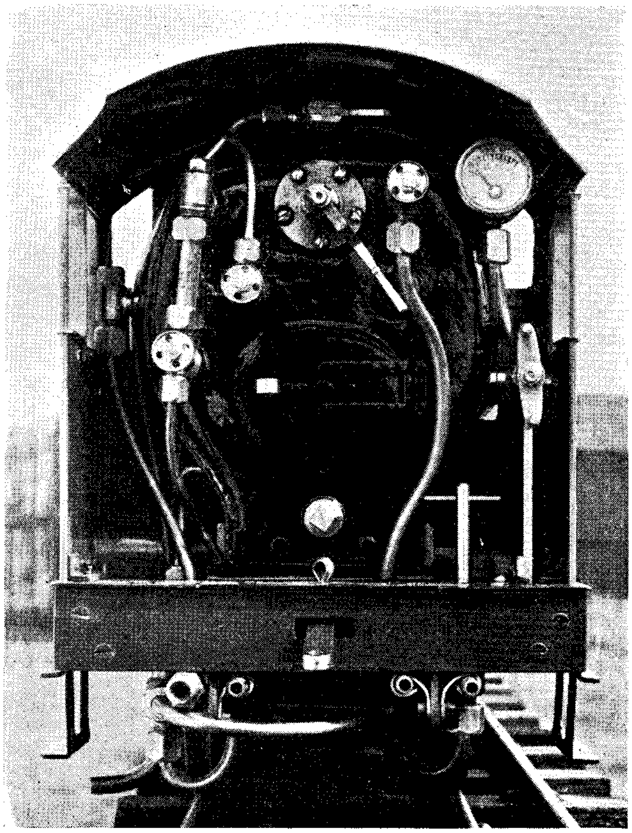


Photo. by] **The cab fittings on "Purley Grange."** [*C. J. Grose*

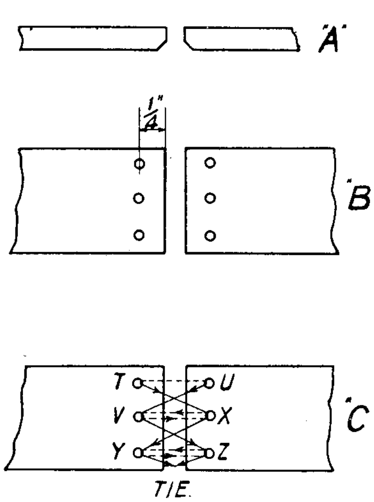
Joining Small Flat Leather Belts

By R. N. J. Edmonds

THE following method of joining 1 in. and $\frac{3}{4}$ in. leather belts has been found very satisfactory, from the point of view of strength, life and quietness of running, and also because the joint conforms to the curvature of small pulleys, without undue tension on the belt.

For 1 in. or $\frac{3}{4}$ in. belts the following method is adopted: The belt is cut to the correct length in the usual way, making certain that the ends are quite square; the underside is slightly undercut (see sketch "A").

In each end of the belt about $\frac{1}{4}$ in. from the end, three holes are punched (see sketch "B"), and it is essential that these are punched opposite each other, otherwise the belt will not draw up square.



These holes may be about 3/32 in. in diameter, and should be clean cut.

To lace the belt, proceed as follows: Obtain a length of strong fishing line, or cord, cut off a piece about 18 in. long, start from the underside of the belt—that is, the side which touches the pulley—push one end through "T" (see sketch "C"), and the other end through "U," pull equally on each end of the line, so that the belt is pulled up tight; from "T" go across to "X," and from "U" to "V," then down through "X" and "V" and across underneath, so that the line which goes through "X" comes up through "V," and *vice versa*. From "X" proceed to "Y" and "V" to "Z." The above process is carried out again, and the line tied at "Y" and "Z," on the top of the belt, the surplus being cut off.

SIMPLE
Dry Cell Construction

ALTHOUGH the lighter evenings are now with us, and torches will not be needed so frequently, and, also, we hope that by next winter things will be back to normal again, there is no reason why the construction of cells should not be undertaken, as the cost per cell is very slight. The zinc containers can be made during any odd moments and the contents filled in later as required.

Firstly, a few words on the operation of a dry cell will not come amiss and will be of interest to the more electrically- and chemically-minded readers. Generally speaking, a dry cell is a Leclanché cell with the electrolyte in the form of a paste. The positive element or negative pole is usually in the form of a cylindrical pot of zinc which acts as a container for the cell. The exciter and the depolarizer are in the form of pastes, the exciter being composed of plaster of paris, flour, zinc chloride, sal ammoniac and water. Surrounding the central carbon rod which forms the negative element or positive pole is paste which consists of manganese dioxide, finely-powdered carbon, zinc chloride and sal ammoniac, the whole is sealed with pitch or wax at the top.

Care must be taken not to confuse elements with poles, the zinc being the positive element or negative pole and the carbon the negative element or positive pole. Since the direction of current is considered to be from the zinc to the carbon inside the cell, and from the carbon to the zinc in the external circuit, the positive pole is on the negative element and vice-versa, i.e., the poles are the terminals.

The chemical action taking place is as follows : when the circuit is closed the action of the sal ammoniac on the zinc produces zinc chloride which combines with the ammoniac and hydrogen is liberated. This is slowly oxidised by the manganese dioxide, water is formed and the polarizing effect of the hydrogen is prevented.

Unless this polarising effect were prevented, hydrogen bubbles would collect on the carbon element and the cell would then be said to be polarised. In this condition the cell would act as though the elements were zinc and hydrogen, and the E.M.F. (see later paragraph) would fall.

In addition, hydrogen is a poor electrical conductor and offers considerable resistance to the flow of current. Polarization, therefore, causes a rapid decrease in the efficiency of the cell, hence the reason for depolarization.

The action of the cell on the conversion of chemical energy into electrical energy produces a difference in electrical pressure or potential between its two elements. This pressure is called the Electromotive Force (E.M.F.) of the cell. It is measured in volts, and is the pressure which forces the current along the circuit.

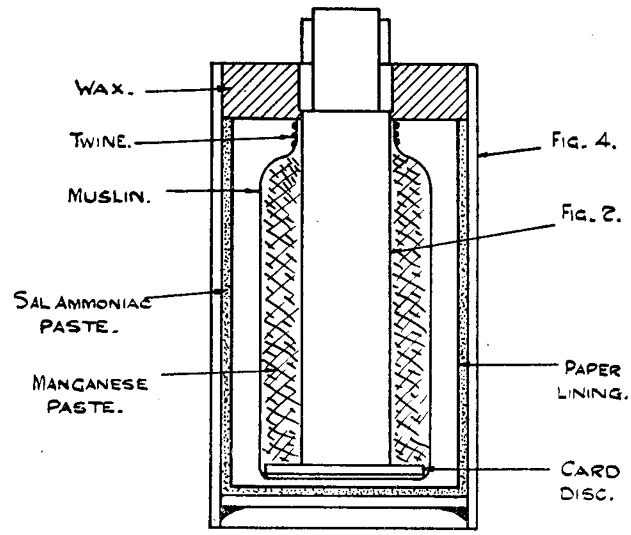


Fig. 1.

Every primary cell, in its normal condition, has a certain E.M.F. which depends on the materials used in its construction, but is wholly independent of the size of the cell ; in the case of a dry cell, the E.M.F. is usually a little over 1½ volts.

Now for the actual construction ; first produce the following materials: Sheet zinc about 24 s.w.g. (0.022 in. thick) ; this can be obtained from a plumber ; manganese dioxide; finely-powdered carbon or graphite; sal ammoniac; plaster of paris ; and zinc chloride, all of which can be obtained at any chemists ; the last-named is a poison, so care must be taken in its use. Keep it in a bottle as it liquefies in air. Carbon rods can either be obtained from old cells and cleaned, or new ones obtained from any electrical stores. Flour, pitch, or wax, thickish cotton or muslin, thread, thin card and notepaper, will also be required.

No sizes are given, as these vary for different types of cells, and it is quite easy to take the main dimensions from an old cell.

To produce the zinc cases, a wooden mandrel *Fig.* 4 is required ; the dia. " *D* " should be about 1/16 in. less than the actual outside diameter of the cell and the length " *L* " 1/16 in. less than the finished container. The zinc is then cut to size, wrapped round the mandrel and soldered along

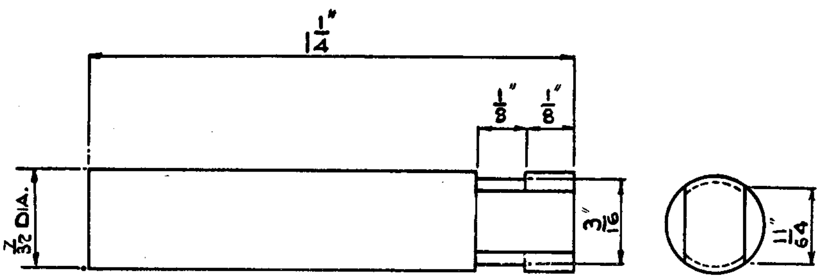


Fig. 2. Material, carbon rod.

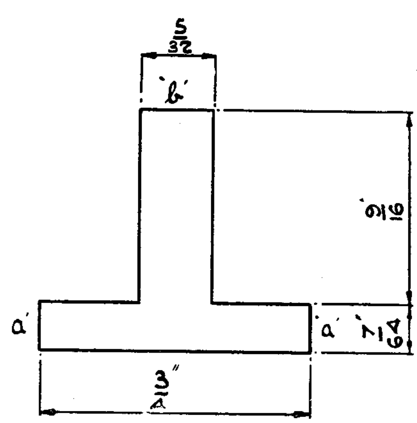


Fig. 3. Material, brass, 0.015 in. thick.

the seam ; a small disc, diameter to suit, is then cut, dropped in at the end and soldered in place, as in *Fig.* 4.

For soldering, either spirits of salts, produced by killing hydrochloric acid with little pieces of odd zinc, or " Fluxite " can be used ; and, of course, the joints must be well cleaned beforehand.

As pure zinc is difficult to obtain and the impurities in ordinary zinc will cause local action to damage the container, the latter can be amalgamated by first dipping in a weak solution of sulphuric or hydrochloric acid, after which mercury is rubbed over the inside surface with which it unites, presenting a silvery-white appearance. As the zinc amalgamates much more readily than the impurities, it continually distils to the surface, keeping the impurities covered.

For the centre carbon rod assembly (*see Figs.* 1 & 2) prepare a small square of muslin, lay the carbon stick on same, and taking a paste consisting of manganese dioxide, 10 parts, carbon powder, 10 parts, sal ammoniac, 2 parts, zinc chloride, 1 part, with sufficient water to form a stiff mixture, form a cylindrical block ; a small disc of card under the end of the carbon rod (*see Fig.* 1) will help. Gather the muslin by the corners, press into shape and tie with thread round the carbon rod under the metal cap. Clean away any surplus mixture and wind the cotton spirally down and up the block to keep it in shape and tie at neck, finally cutting away any loose ends of muslin.

Incidentally, if the carbons are not fitted with caps, suitable contacts can be made by taking pieces of thin brass, about 28 s.w.g. (0.0148 in. thick) cutting to the shape shown in *Fig.* 3, bending the ends *a* round the carbon rod and the tag *b* over the end and down on to the ends *a* and soldering all three together (*see Fig.* 1).

Now make a mixture of flour (2 parts), plaster of paris (2 parts), sal ammoniac (10 parts), and zinc chloride (1 part) with sufficient water to form a fairly thin paste. Smear this well inside the zinc container, using something that can be

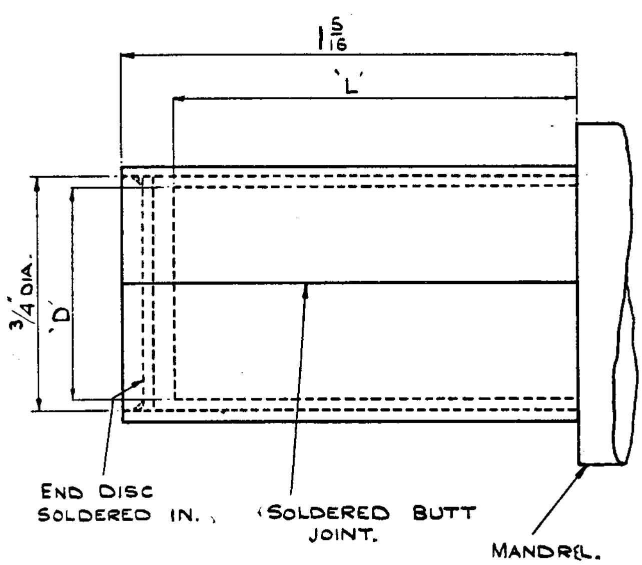


Fig. 4. Material, 28 s.w.g. zinc.

burnt easily afterwards. Next, line in with a thin card disc at the bottom ; and a sleeve of paper, placing the carbon assembly inside the sleeve.

The paper should be of a fairly absorbent quality, and care taken that no trace of the carbon-manganese mixture finds its way into the polarizing paste, this can be ensured by washing the fingers free of all traces of carbon-manganese

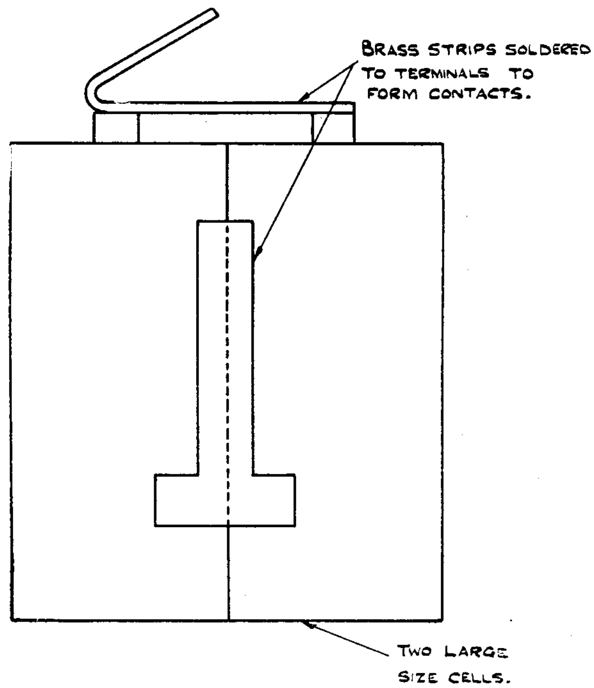


Fig. 5.

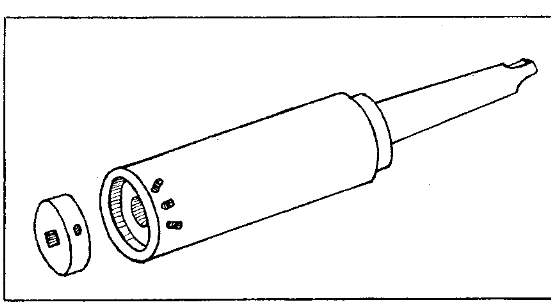
mixture before mixing the second paste. Now place a collar of thin card over the carbon rod and seal with pitch or wax.

The complete cell can then be covered with brown paper to insulate same ; if required for a torch the base need not be covered as it is usually the negative contact. In a torch two or more cells can be bound together with paper and connections of thin wire soldered between the cells and outer contacts of thin brass strip added (*see Fig.* 5). Two of the cells of the sizes given would be required to make one No. 8 size battery.

It should be pointed out that as, in all probability, the construction of cells is covered by numerous patents they should not be made for resale.

ADAPTING A TAILSTOCK DIE-HOLDER FOR TAPPING

ANYONE possessing a tailstock die-holder can adapt this handy tool for tapping in the following manner. Turn three or four discs the same diameter and thickness as a die—i.e., 13/16 in. diameter by ¼ in.—and drill each



with a different size hole in the centre ; square out the holes with a file to suit various sizes of taps. Drill a dimple on the edge to prevent the disc turning, and the tapper is ready for use. See accompanying sketch.—J.B.

Queries

Enquiries from readers, either on technical matters directly connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a coupon from the current issue, with a stamped (2½d.) addressed envelope, and addressed: "Queries and Service," THE MODEL ENGINEER, 60, *Kingsway, , London, W.C.2.*

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their merits, in respect of their general interest to readers, such as by a short explanatory article in an early issue. In some cases, the letters may be published, inviting the assistance of other readers.

In cases where the technical information required involves the services of a specialist, or outside consultant, a fee will be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

7,751.—Adjusting a New Lathe—G.McN. (Stokesley)

Q.—What degree of accuracy should one expect when one purchases a new bench lathe, about 3 in., valued about £10? I ask this because I have just bought one (the price has gone up to about £12 now—*c'est la guerre*), and I have found the following in a *rough* check-up.

Loose steel slip of compound slide—small holes for grub-screws incorrectly drilled. Feed of same—jumpy. Back gear—will not rotate smoothly but jumpy like above. Tailstock ram—so tight that I cannot drive it out to clean and lubricate it. Mandrel lock-nut about 1/50 in. out of true, and rubs the bronze bearing in one place only.

This is only my second lathe. The previous one was second-hand, and I didn't mind some little eccentricities in its behaviour. But somehow I feel that this one has too many faults on the surface. I am almost afraid to put the indicating gauge on it for fear of what I may find.

I have not considered the complete lack of adjustment to lathe parts as anything unusual. I should run over the adjustments of even the finest lathe as a matter of course. But I should like to know if these faults are what one should normally expect, If so I hope "L.B.S.C." won't wait until the World War 2 is over before he gets busy with the little lathe he temptingly dangled before us in your issue of 2nd November last.

A.—There is very little advice of the intelligent order we can offer you in respect of the lathe errors you describe. There are a few comments, however.

In the first place, *re* grub-screws for adjusting slip (presumably on top slide); if only one of the indents in slip tallies with a screw point the remainder will adjust up, even if they are out of register with their indents. In one lathe we have, indents are only put at each end, the intervening grub-screws are made round ended and take up on a flat surface. The idea of the indent, which can be made very wide and full to allow the slip to adjust up or down if necessary, is to prevent the slip sliding along out of position, otherwise it is rather a hindrance than help in the matter of adjustment. In the better class lathes (which will cost considerably more than the one you describe, even if a bench lathe only), keep screws, with sunk heads and shanks in slots, are fitted to keep the slip in position, then no adjusting screw indents are put at all.

You do not say, however, whether the slip can be adjusted up free of side shake. End shake is almost sure to occur, and if the traverse is jumpy, it is almost sure to be due to a drunken or out of truth traverse screw; and, if you can prove it, you can expect the makers to put it right. The same thing applies to the mandrel lock nut, which is evidently either on a drunken thread or is not faced normal to its screw axis. To some extent it does not matter a great deal if the nut bears only in one point on itself, so long as it bears evenly all round on its bearing. But you say it only bears at one point on the bearing, which, in conjunction with the out of truth, is serious, and you should expect to get that corrected by the makers. The drunken thread idea is not likely to be the fault. The out of normal face of the bearing is, therefore, the great fault of this error and should be corrected.

The jump in the back gear may be due to incorrect depthing and may be easily corrected by a variation of the gear depth one way or the other by altering the stop on the tumbler. The other reason is that the spur wheel of the back gear shaft runs out of pitch circle truth, and this should be corrected by bushing and reboring the wheel. Out of truth of the mandrel spur is not likely to occur because it is so apparent when running on single gear; but, if it occurs, the wheel may be corrected in the same way. The rapid jump and certain amount of noise on cut, is usually due to wide depthing and generally goes out if the wheel gear is closed a little. In any case, this gear error has got to be very bad to affect the turning much, because there is very little finish turning done on double gear, and barring other errors of adjustment, is not likely to give rise to chatter alone.

We cannot quite accept the fact of not being able to drive out tailstock barrel. You are probably trying to drive it the wrong way up to the key at dead end of feather, for instance. If it was ever put in the tailstock it must surely drive out. Perhaps it is a good fit and has got a bit of dirt wedged in tightly. If so, and you are sure of key clearance and direction to drive, and with the lock out of adjustment, try warming the outside of barrel proper rapidly so that it expands and will allow you to start that which you call the ram, which should be kept cool as possible.

We have met all the things you describe in the cheaper lathes (and your lathe is of the cheaper variety), and some of them in the more expensive we could actually describe. One does not expect these things, but you occasionally get them, nevertheless. The only way is to face the troubles philosophically, and persuade the makers to correct those that matter as soon as possible, so that "fair wear and tear" does not come into it.

7,753—Lead for Valve Gears—Mr. H. (Dewsbury)

Q.—Can you tell me of the standard formula for finding the lead on a locomotive valve-gear?

A.—There is no such thing! The amount of lead required for any particular type of locomotive cannot be found by any simple calculation; it depends upon the duty required of the locomotive, and is best settled by observation and experience. Your question seems to indicate that you do not understand the purpose of lead, which is to allow steam to be admitted to a cylinder just before the piston has completed its stroke. To achieve this, the valve is so set that it begins to open the steam-port in time to admit a quantity of steam to form a "cushion" on which the moving piston can damp out its kinetic energy, and so prevent undue stresses occurring in the piston-rod, connecting-rod and axlebox, twice in each revolution of the main crank. In a perfect valve-gear, therefore, the lead would be variable from a minimum for slow speed to a maximum for high speed, since it is at high speeds that the advantage of lead becomes most apparent. In any attempt to pre-determine an amount of lead for a particular engine, however, other factors, such as the sizes of steam ports, weights of pistons and piston-rods, pressure of steam in the steamchest and the clearance between piston and cylinder cover, would have to be taken into account, quite apart from the speed of the engine. The lead, as expressed in fractions of an inch, or other unit of length, is the amount by which the valve has uncovered the steam port when the main crank is at dead-centre.

7,755.—Projection Arc Lamp—H.T.B. (Rathlin Island)

Q.—I wish to use an arc lamp in a full size cine-projector, and would be grateful for your advice on the following points :—

(1). Would 50 volt 5 amps. dynamo be large enough to work the lamp ? Projection to be a distance of 30 ft. only.

(2). What size of carbons would be suitable ?

(3). As I wish to drive the dynamo from a $1\frac{1}{2}$ h.p. Villiers engine, and use the arc lamp direct, what system of wiring should I use in order that dynamo is not damaged when lamp is cut out, that is, the period between starting engine and striking arc ?

(4). If the idea is practicable, what amount of resistance should I use in series with lamp ?

A.—(1) The voltage and amperage stated should be quite sufficient for your purpose. (2) The size of carbons will depend to some extent on the type of lamp employed, but if this is of the type generally used for this purpose, we suggest that positive carbons about 8 mm. or 5/16 in. diameter and negative carbons about 5 mm. or 3/16 in. diameter will be suitable. This applies to ordinary solid carbons ; if cored carbons are used, they may be of considerably larger diameter. (3) No special system of wiring will be required as the dynamo, if of the shunt or compound-wound type will regulate itself, within limits, to the load ; but some form of governor will be required on the engine, to prevent it from racing when the load is removed. (4) A 50-volt dynamo may be used to feed an arc lamp directly, without the use of a resistance, but it will usually be found more convenient to introduce a variable resistance up to maximum of about 20 ohms, for controlling and striking the arc.

7,739.—Wood Turning Lathe Speeds—D.H. (Lustleigh)

Q.—I have two lathes—a Milnes 5 in., type " Y," and a Cunliffe & Croom 6 in. ornamental wood-turning—for which I am now arranging motor drives. In both lathes the mandrel runs in hardened steel cone-bearings. Assuming correct adjustment and adequate lubrication, what would you consider to be the maximum safe rates of revolution for these mandrels ?

The two lathes are differently equipped, so it is sometimes convenient to use the Milnes for turning wood. I realise that if the Milnes countershaft were given a particularly high speed, it would be in addition to, and not in lieu of, the normal speed of 250 r.p.m.

A.—In the case of the Cunliffe & Croom lathe, which is, by description, a genuine wood-turning lathe, and made for high speeds, there is no reason, so far as the bearings are concerned, that this machine should not run at 3,000 to 4,000 r.p.m., for the purpose of soft wood-turning. The important point to consider is whether these coned journals and bearings are in sufficiently accurate fit conditions to hold the oil, as they no doubt were when it was made by that particular firm. The other point to consider is the balance of chucks. For instance, it is not advisable to run screw on heavy jaw chucks at the above speeds. On shutting off, one is likely to have such chucks carry on and, unscrewing rapidly, become a distinctly dangerous projectile. In high-speed wood chuck turning, it is usual to use relatively light exact balance screw on cup chucks, which offer no resistance to being delayed by hand on stopping the lathe, and, in any case, are not so heavy as to be likely to unlock from the lathe nose shoulder when at speed or stopping. The trouble is not likely to occur in centre turning wood, because the driver is usually a light fork or crotch screw on centre, and is, of course, retained by the tail centre. In any case, where drivers and carriers are used at these speeds they must be very carefully balanced, or, better still, not used at all, as being likely to cause accidents to fingers.

Of the Milnes lathe, the same thing applies in the matter of suitability of bearings for the purpose of high speed turning. The question of the weight and suitability of chucks is, perhaps, a greater consideration than in the other lathe. Here, for instance, a fairly heavy faceplate may be fitted, but it should be clear that such a chuck (a faceplate is a chuck because it both drives and guides the work) should never be run at several thousand revs. per minute trusting to its screw-on attachment.

We do not think that the Milnes countershaft should run at anything like these speeds, and can only suggest that a fairly high belt gear-up should be applied from it to the lathe and not allow of anything more than 1,000 r.p.m. at the very most, and then only if the countershaft has long self-aligning bearings.

Letters

Model Locomotive Performance

Dear Sir,—Referring to Mr. W. B. Hart's article published in your issue of February 29th last, may I offer the following comments ?

(1) The Romford Model Engineering Club is endeavouring to compare the *efficiency* of the various locos. as a whole. This appears to me to mean the amount of work done in comparison to the fuel consumed. The amount of water evaporated per unit of fuel would, presumably, give an indication of the efficiency of the boiler, but this is of little practical value if the steam is used wastefully. The record of water consumption, therefore, is not taken into consideration, although it may indicate in comparison with the other two factors, i.e., fuel consumption and work done, which *part* of the loco. is most or least efficient.

(2) The R.M.E.C. commenced its investigations on the lines adopted by Mr. Hart, but we found it almost impossible with an ordinary spring balance to get a " draw-bar pull " reading that was any more accurate than a guess, owing to the oscillation of the pointer. This difficulty was partially overcome when Mr. F. F. French made and calibrated a spring balance with a " leaky cylinder " steady. This, however, while exceptionally useful for comparing the " draw-bar pull " in specific places and with varying loads, did not help us very far towards that efficiency comparison, but it did enable us to prove, as Mr. Hart has done, that " draw-bar pull " has little relation to " load hauled " either under the same track and bearing conditions or *vice versa*.

(3) We have experimented with a dynamometer car giving a continuous record of the " draw-bar pull," together with a time *or* distance record. *I do not agree, however*, with Mr. Hart that *speed* has any bearing on the matter other than its effect, which is shown up in the " draw-bar pull." It seems to me that if we can perfect a dynamometer car producing a record on the lines that Mr. S. W. Carr's produced in 1938 (I believe you have a specimen), namely a strip of paper passing under an inker at a uniform speed—the inker recording the " draw-bar pull," we can by ascertaining the area enclosed between the graph and " zero " line get a comparison.

I believe, however, that whilst in theory this gives a perfect basis for comparison of locomotives of all sizes, in practice, even in $\frac{1}{2}$ in. scale, a model of a large locomotive

will always have the advantage of a model of a smaller one, though the construction and the manipulation be equally good.

In conclusion, I express the hope that it may be possible for the Romford Club to follow up the dynamometer car experiments, and in the meantime that some readers of "Ours" may come along with their views and suggestions.

Yours sincerely,

Romford. L. R. CHILVER,
Chairman, R.M.E.C.

Clubs

The Society of Model and Experimental Engineers

The next meeting of the Society, to be held at 56, Old Bailey, London, E.C.4. on Tuesday, June 4th, at 7 p.m., will be a Competition, Track, and Stationary Engine Meeting. The Society's boiler will be under steam for the running of stationary models, and the track, which is now stored permanently at the Hall, will be available for members who desire to run locomotives.

Visitors' tickets for the meeting, and full particulars of the Society may be obtained on application to the Secretary, H. V. STEELE, 14, Ross Road, London, S.E.25.

The Islington Model Engineering Society

An open night in aid of the local church will be held on June 15. Tickets, 3d. each, may be had from the Hon. Sec. There will be an exhibition of recently constructed models, also a film display. Work has been started on the Society's new workshop. New members are always welcome, and full particulars may be had from the Hon. Sec., T. H. BRIGGS, 39, Blandford Street, Baker Street, London, W.1.

The York and District Society of Model and Experimental Engineers

The next meeting of the above society will be held on June 7th (Friday), at 7.30 p.m., in The Dining Hall, The Cocoa Works, York.

Hon. Sec.: WM. SHEARMAN, 28, Terry Street, York.

Norwich and District Society of Model Engineers

There was a good attendance of members at the usual monthly general meeting of the Society held recently, and after the routine business, several drawing competitions were held, organised by Mr. Wyatt, and judged by Mr. H. O. Clark.

The President then produced a chest of drawers which he had made from tobacco tins, and described the method of making the frame and drawers.

The next meeting of the Society will be held on June 6th at 7.30 p.m., when a Model Night and Auction will be held. All members are asked to bring bits and pieces for auction, and also parts of models they have made.

Secretary, F. W. LOVICK, 24, Wymer Street, Norwich.

Hull Society of Model Engineers

The next meeting of the above Society will be held at the Wheatsheaf Hotel, Prospect Street, at 8 p.m., on Friday, May 31st. Hon. Sec., F. BELLAMY, 49, Wold Road, Hull.

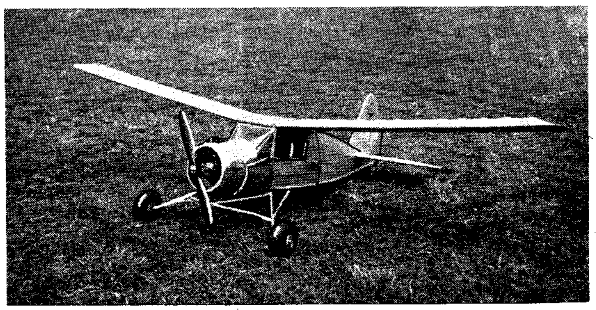
New Books

(Published by Percival Marshall & Co., Ltd.)

1001 Mechanical Facts, edited by Percival Marshall, may be best described, perhaps, as a fully-illustrated and handy little "Enquire Within" of simple mechanical knowledge for all who are interested in engineering. In no sense is it comparable with any known compendium, dictionary or abridged encyclopaedia; except for the inclusion of a few standard tables and data, it is entirely original, in that the contents have been specially written in the simplest possible language. From end to end, the contents consist of concise little paragraphs, grouped into fifteen sections covering all the better-known phases of mechanical engineering, and should be handy and useful for reference by the wide, sophisticated modern public.

* * *

Models for Flying, by L. H. Sparey and C. A. Rippon; price 3s. 6d. net. This book forms an excellent corollary to the "New Model Aeroplane Manual" by the same authors, in that it seems to begin where the earlier book left off. The authors deal exclusively with flying models, in this later handbook, and they have done their work in an extremely thorough manner. The text is always



readable, informative and entertaining; and although a considerable amount of purely technical matter has, of necessity, been included, it is really essential to the subject and is well supported by excellent practical illustrations which are very numerous. Both indoor and outdoor types of flying models are fully dealt with, while a chapter devoted to gliders deserves to be mentioned, if only for the instructive and practical advice that it gives. Naturally, the problem of providing the power for driving model aeroplanes receives a good deal of attention, and is very lucidly discussed. The last chapters of the book consist of descriptions and fully-detailed illustrations of well-known designs of flying models, such as the "Gnat," the "Northern Arrow," the "Harding" biplane, the "Water Sprite" and the "Premier Lion," augmented by photographs of actual examples in flight. The book is not, in any sense, a theoretical treatise; it is a practical and constructive handbook, the work of two highly experienced enthusiasts who possess the knack of passing on their wealth of practical knowledge to others.

NOTICES.

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall and Co. Ltd., 60, Kingsway, London, W.C.2. Annual Subscriptions, £1 10s., post free, to all parts of the world.

All correspondence relating to advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 60, Kingsway, W.C.2.